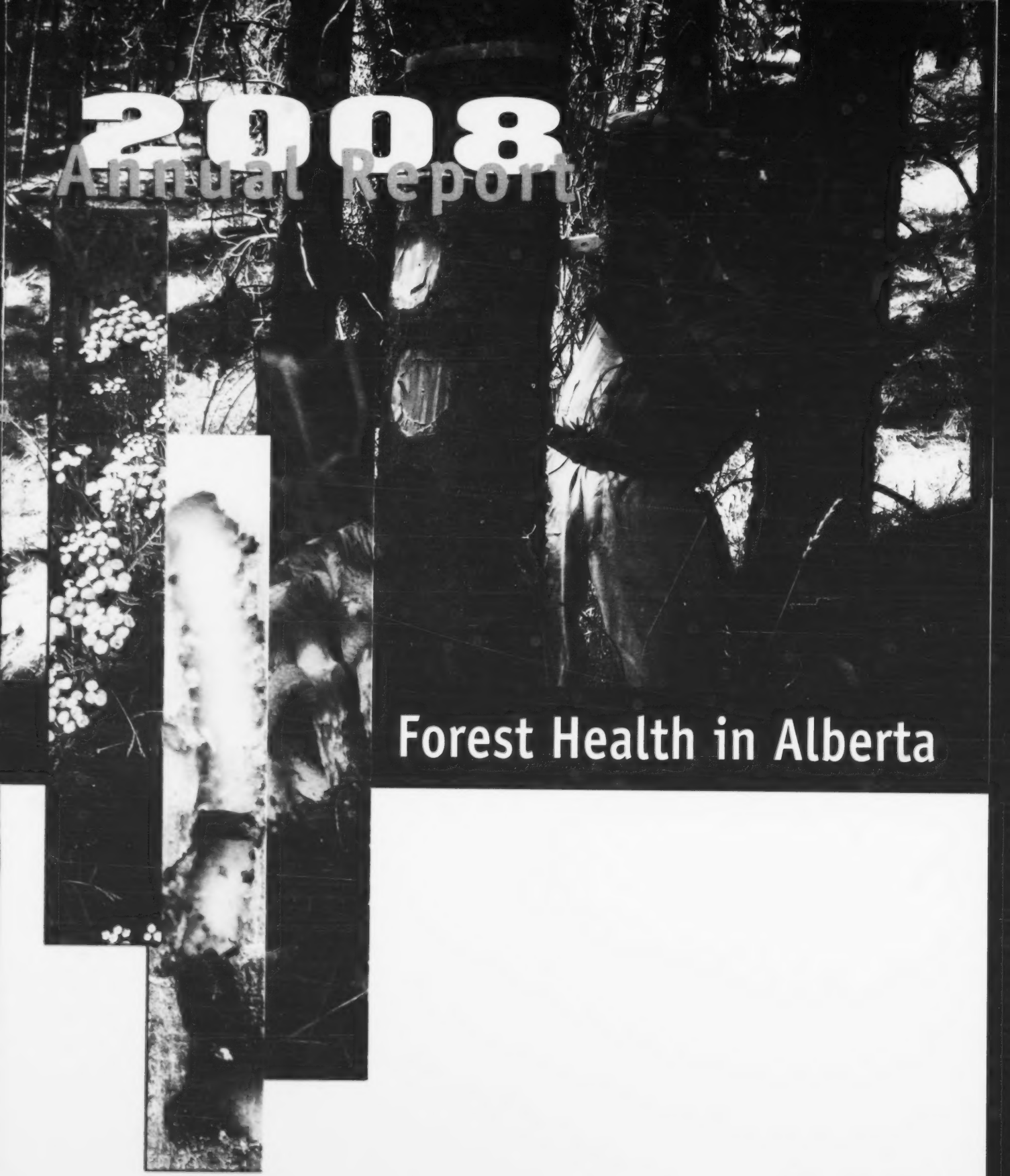

2008 Annual Report

Forest Health in Alberta

Government of Alberta

2008 Annual Report
Forest Health in Alberta

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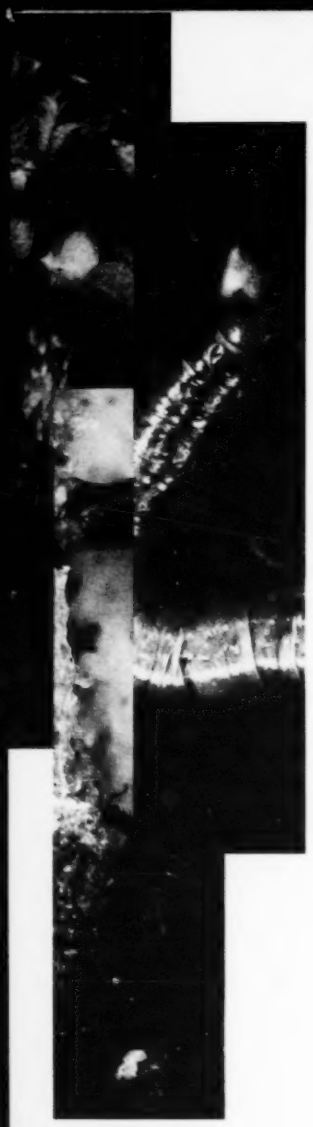


Executive Summary

This report contains results of forest pest surveys and pest management programs carried out under Alberta Sustainable Resource Development's (SRD) Forest Health Program in 2008.

The mountain pine beetle (MPB) was the most harmful forest pest in Alberta in 2008. Mature pines with red crowns symptomatic of MPB were observed scattered over a wide landscape in northern Alberta during aerial surveys carried out in 2007. These pines with red crowns were the result of a massive influx of beetles from British Columbia to Alberta in summer 2006. The results of long-distance aerial dispersal surveys indicated influx of MPB into the Clearwater Area for the first time during this outbreak. This survey also indicated that the Lac La Biche Area did not have an influx of MPB in 2008. During the 2007-2008 beetle year (August 15, 2007 – August 14, 2008), ground surveyors detected 125,054 green-attack pines. The green:red attack ratios observed in fall 2007 indicated that beetle populations were decreasing in Kakwa Interprovincial Park, were mixed in the Peace and Smoky areas but were increasing in the Lesser Slave Area and in Wilmore Wilderness Park. The R-value (measure of population trends) surveys carried out in spring 2008 forecasted low beetle populations in the leading edge zone where control activities were carried out in 2007-2008. These survey results also predicted high population growth in southwest Alberta and in a few pockets in northern Alberta.

Under the SRD beetle management program, 125,137 infested pines were cut and burned in 2007/2008 beetle year. Another 119,909 infested pines were removed by the MPB-affected municipalities under SRD's grant program. Under sanitation harvest program, forest companies removed 2,340,904 cubic metres of wood from beetle-infested stands.

There were no MPB attacks in genetic plantations surveyed in 2008.

Compared to 2008, lower numbers of MPB-infested trees are expected in 2009 in the "Leading Edge Zone" where active control programs were undertaken in 2007/2008. An increase in MPB-infested trees is expected in the Southern Rockies, Clearwater and Peace areas in 2009.

The spruce budworm defoliated an estimated 160,408 hectares of spruce forest in 2008. This is a 47 per cent increase in the defoliated area compared to that in 2007. The severely defoliated area doubled in 2008 compared to that in 2007. Most of this defoliation was recorded in the northeast. There was some resurgence of budworm populations in the northwest where a 17-year budworm infestation collapsed in 2005. The forecast for 2009 calls for an increase in risk of spruce budworm outbreaks occurring in northeast Alberta and in the Upper Hay Area in the northwest.

In 2008, the western spruce budworm infestation over Porcupine Hills in the southwest also spread further south and west, reaching 22,471 hectares. This is a 27 per cent increase in the defoliated area. However, the severity of defoliation decreased to a moderate level in most of the affected areas. A light to moderate defoliation is expected in 2009 in western spruce budworm affected areas.

Forest pest caused aspen defoliation was scattered over an estimated 2.9 million hectares in the Green Zone in 2008. This defoliation was attributed to the forest tent caterpillar, large aspen tortrix and Bruce spanworm. Most of this defoliation was observed in the northeast while patches of defoliated areas appeared in the northwest where the tent caterpillar populations collapsed in 2007. Bands of light aspen defoliation were observed across central Alberta and in the southwest.

The extent and severity of invasive alien plant species in the forested areas were surveyed. Vast majority of these infestations were either on or near industrial dispositions. SRD staff either used herbicides or hand-picking to control these plants; a few cooperatives involving SRD, industry and municipalities also participated in controlling these invasive plant species. SRD updated 2008 distribution maps of 10 most common invasive plant species in the Green Zone in Alberta.

Introduction

This report provides information on the programs carried out by the Forest Health Section of Alberta Sustainable Resource Development (SRD) in 2008 in relation to its business goals. Reference is made to other Forest Health-related programs in Alberta where these programs are either linked to or have a direct bearing on programs carried out by the Forest Health Section.

This report provides a concise account of Forest Health programs carried out in Alberta. Links are provided, where available, for the reader to get more detailed information about these programs.

The pest-related activities are reported on a calendar year basis except those of the mountain pine beetle (MPB). The MPB program is reported on a "beetle year basis, i.e., August 15, 2007 to August 14, 2008."

In 2008, the mountain pine beetle was the most harmful forest pest in Alberta. The invasive alien plants and major forest defoliators are the other high priority species dealt with under Forest Health Program.

The surveys reported in this document were carried out for operational purposes over forested Crown land in Alberta. These surveys do not necessarily cover the entire provincial land base. Although every effort is made to ensure accuracy and completeness of this report, its integrity is not guaranteed by SRD.

Forest Pest Conditions and Management Programs in 2008

Mountain Pine Beetle Management Program

Objectives, goal and expected outcomes of Alberta's mountain pine beetle (MPB) management program are described in the Mountain Pine Beetle Management Strategy (Anon. 2007a).

MPB Management program is composed of:

1. Detection and assessment of current infestations

2. Action to control the MPB

3. Education, Increased Awareness and Communication

Details of the 2008 program are reported on a "beetle year" basis, i.e., August 15, 2007 to August 14, 2008. This time period approximately coincides with the onset of beetle flights in 2007 to onset of beetle flights in 2008.

Detection and Assessment of Current Infestations

Overview Aerial Surveys

Heli-GPS surveys were carried out in fall 2007 to detect and record locations of pines with red crowns symptomatic of MPB infestations. The procedure for these surveys is described in the SRD Heli-GPS Manual (Anonymous, 2007b).

The fall 2007 survey results (Figure 1) indicated that pines with red crowns were distributed over a much wider area compared to that in fall 2006 (Figure 2). This large increase in the affected area is due to a widespread aerial dispersal of MPB into northern Alberta after a massive influx from British Columbia in July 2006. It was not possible to detect most of these beetle attacks during 2006 because the resulting green-attack trees were scattered over a wide area that was infested by the beetle for the first time. As well, there were no red-attacked trees associated with these green-attacks to assist aerial detection. Ground surveys to detect these green-attack trees in 2006 were also limited by logistical concerns. The faders resulting from these 2006 attacks became visible in fall 2007, making it possible to readily detect the attack sites from the air.

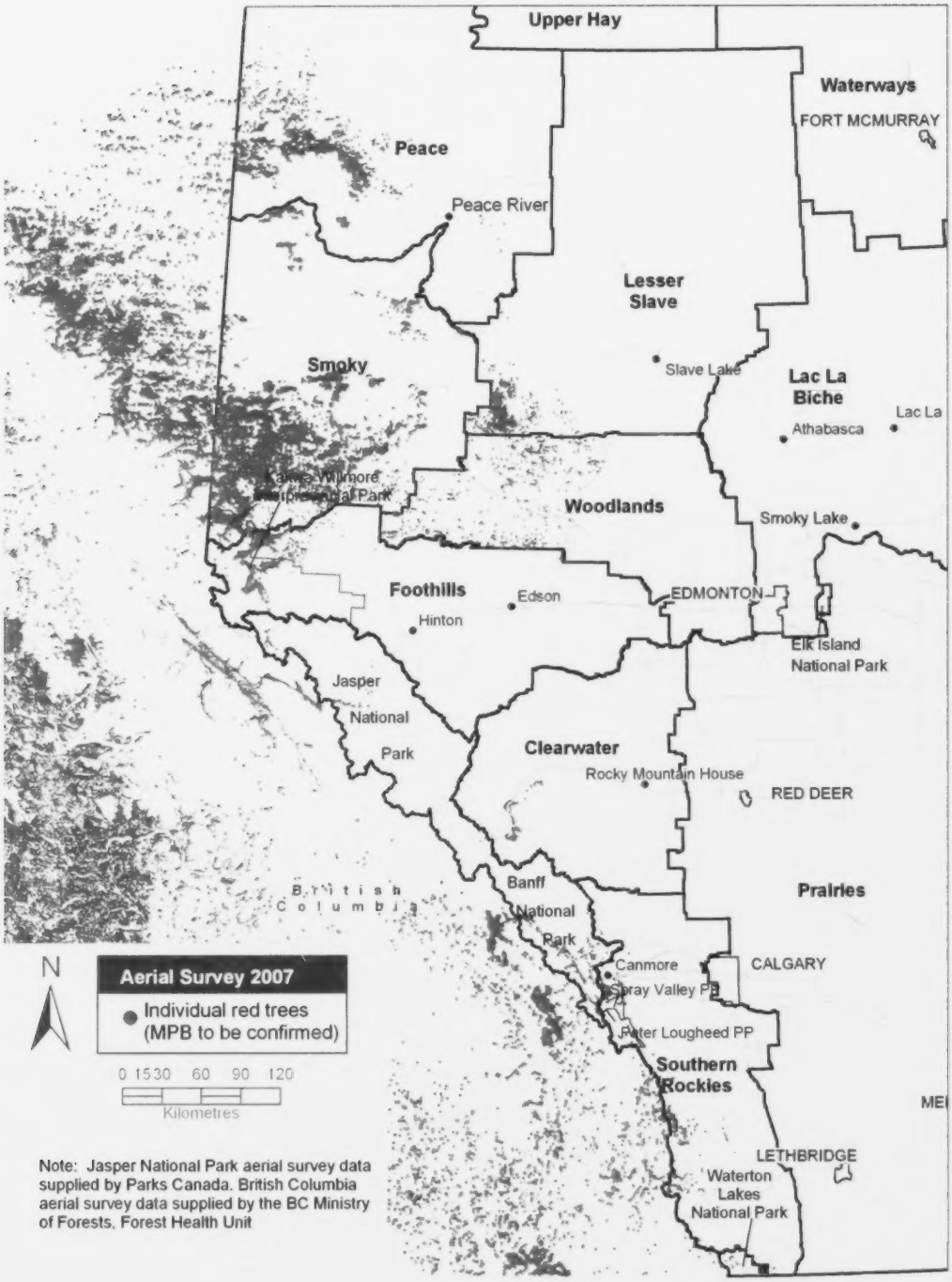


Figure 1
Results of the fall 2007 heli-GPS surveys showing locations of suspected mountain pine beetle-attacked pines with red crowns detected in Alberta.

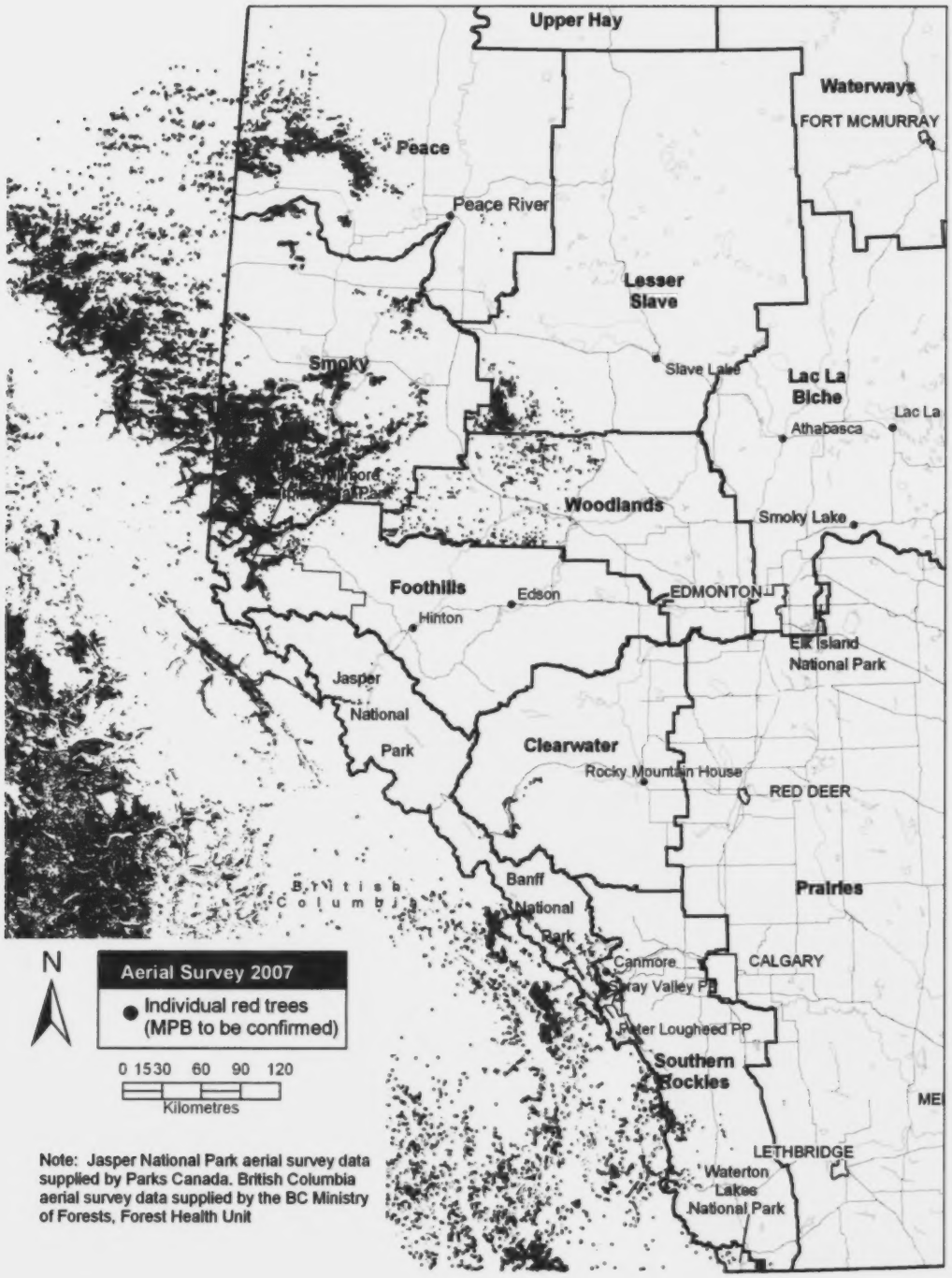


Figure 1
Results of the fall 2007 heli-GPS surveys showing locations of suspected mountain pine beetle-attacked pines with red crowns detected in Alberta.

Figure 2
Results of the fall 2006 heli-GPS surveys showing locations of suspected mountain pine beetle attacked pines with red crowns detected in Alberta.

Long-Distance Dispersal Monitoring

Long-distance aerial dispersal of beetles during their 2007 flights was monitored by using aggregation pheromone-baited plots, established in July 2007, i.e., before 2007 beetle flights. One plot per selected township was setup in highly susceptible stands that were strategically located in areas with no previous beetle activity. The procedure for dispersal monitoring is described in the MPB Field Guide (Anon. 2008a).

Figure 3 shows occurrence of MPB hits at dispersal monitoring sites following 2007 flights. In the Clearwater Area, where no previous major beetle activity had been recorded, several monitoring plots had beetle hits in 2007. No beetle hits due to long-distance dispersal were detected in the Lac La Biche Area. The results of the dispersal monitoring plots indicated there was neither a massive MPB migration into northern Alberta nor further eastward MPB expansion in 2007.

Ground Surveys to Detect Green Attacks

Ground surveys were carried out to detect green attacks in areas where pines with red crowns were detected during Heli-GPS surveys. Depending on the pattern of infestation either concentric or transect surveys were carried out to find green attack trees. The procedures for these surveys are described in the manual "Mountain Pine Beetle Detection and Management in Alberta (Anon. 2008b). The results of these surveys are summarized in Table 1.

Population Trends

Table 1
The number of green-attack trees detected in Alberta during ground surveys carried out in the 2007-2008 mountain pine beetle year.

Smoky	95,795
Lesser Slave	1,779
Peace	3,804
Upper Hay	71
Southern Rockies	13,021
Foothills	9,512
Woodlands	1,072
Total	**125,054**

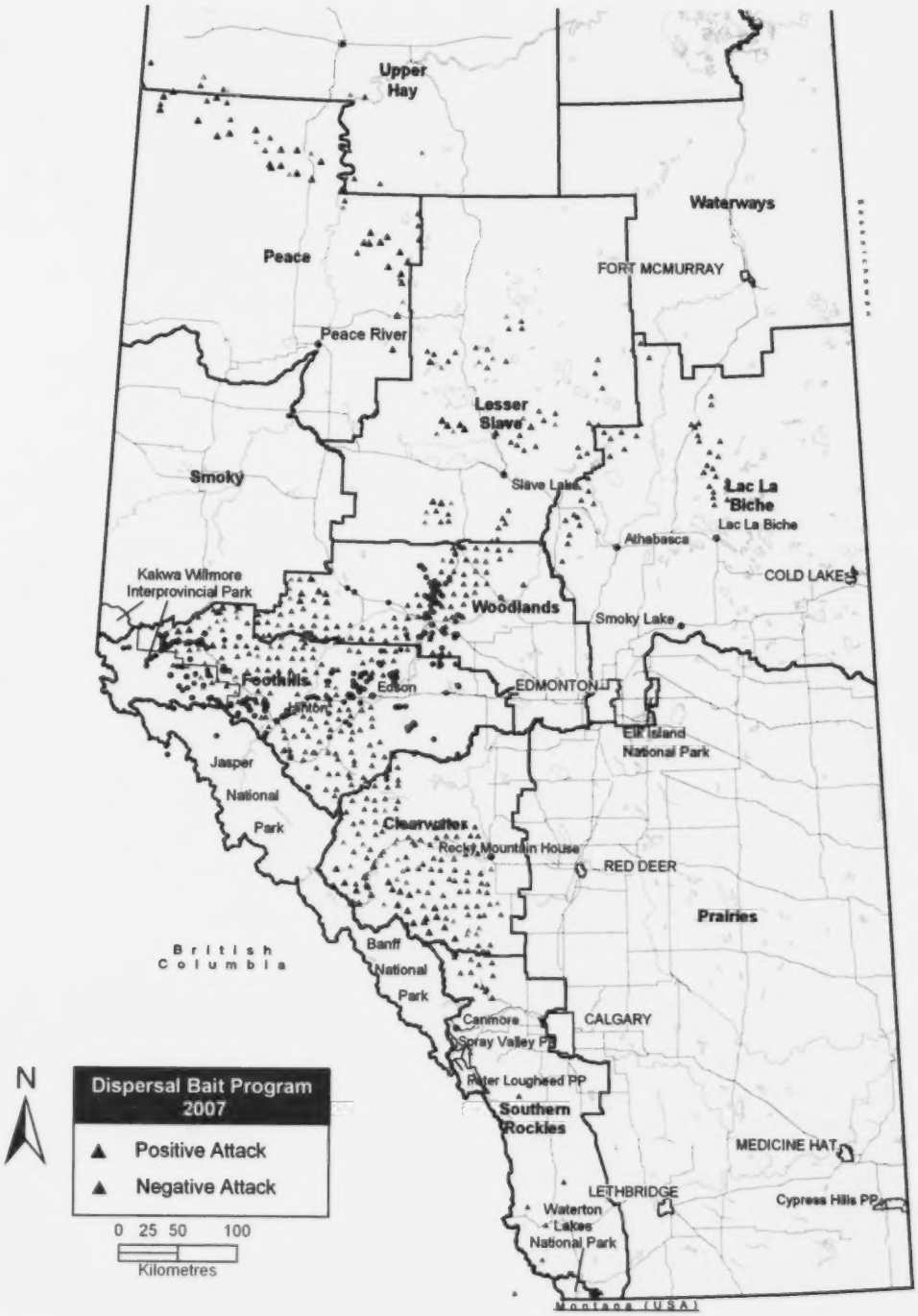


Figure 3
Results of MPB long-distance aerial dispersal monitoring pheromone bait program carried out in July-October, 2007 in Alberta.

Green:Red Ratios

The green: red ratios — i.e., ratio of currently attacked trees with green crowns (green attacks) to one-year old attacked trees with red crowns (red attacks) — were determined by following the procedures described in the MPB Field Guide (Anon., 2008a). A green:red ratio of >1 indicates an increasing population and a ratio of <1 indicates a declining population. A green:red ratio of >7 indicates possibility of beetle immigration to the site. Figure 4 shows green:red ratios observed in areas surveyed in fall 2007 in northern Alberta.

Green:red ratios observed indicated a decreasing trend in populations in Kakwa Interprovincial Park and an increasing population trend in Willmore Wilderness Park. Population trends were mixed in the Peace and Smoky areas. There was an increasing trend in populations in the Lesser Slave and Woodlands areas.

R-values

R-value is another measure of population trends. R-value for a given site is the average ratio of the number of beetles that entered the sample areas of the tree stem to the number of living brood found in those sample areas. Based on access, number of infested trees, spatial coverage and climatic suitability zones identified by a model (Carroll *et al.* 2004), 15-20 plot sites in each climatic zone were selected to determine R-values. R-values were determined in mid-late spring in 2008 after most control operations were completed. The sampling procedure for R-value determination is described in the MPB Field Guide (Anon. 2008a).

The population forecast based on R-values is shown in Figure 5. Relative R-values were used to demarcate areas where low, moderate and high levels of MPB population growth were expected in 2008 in the province. MPB population growth was expected to be low in the "leading-edge zone" where aggressive control action was taken. Most of the infested areas in the south and some pockets of infestations in the north were expected to have high population growth. The other infested areas were expected to have a moderate population growth (Figure 5). The sites with relatively higher R-values were to be prioritized for control action.

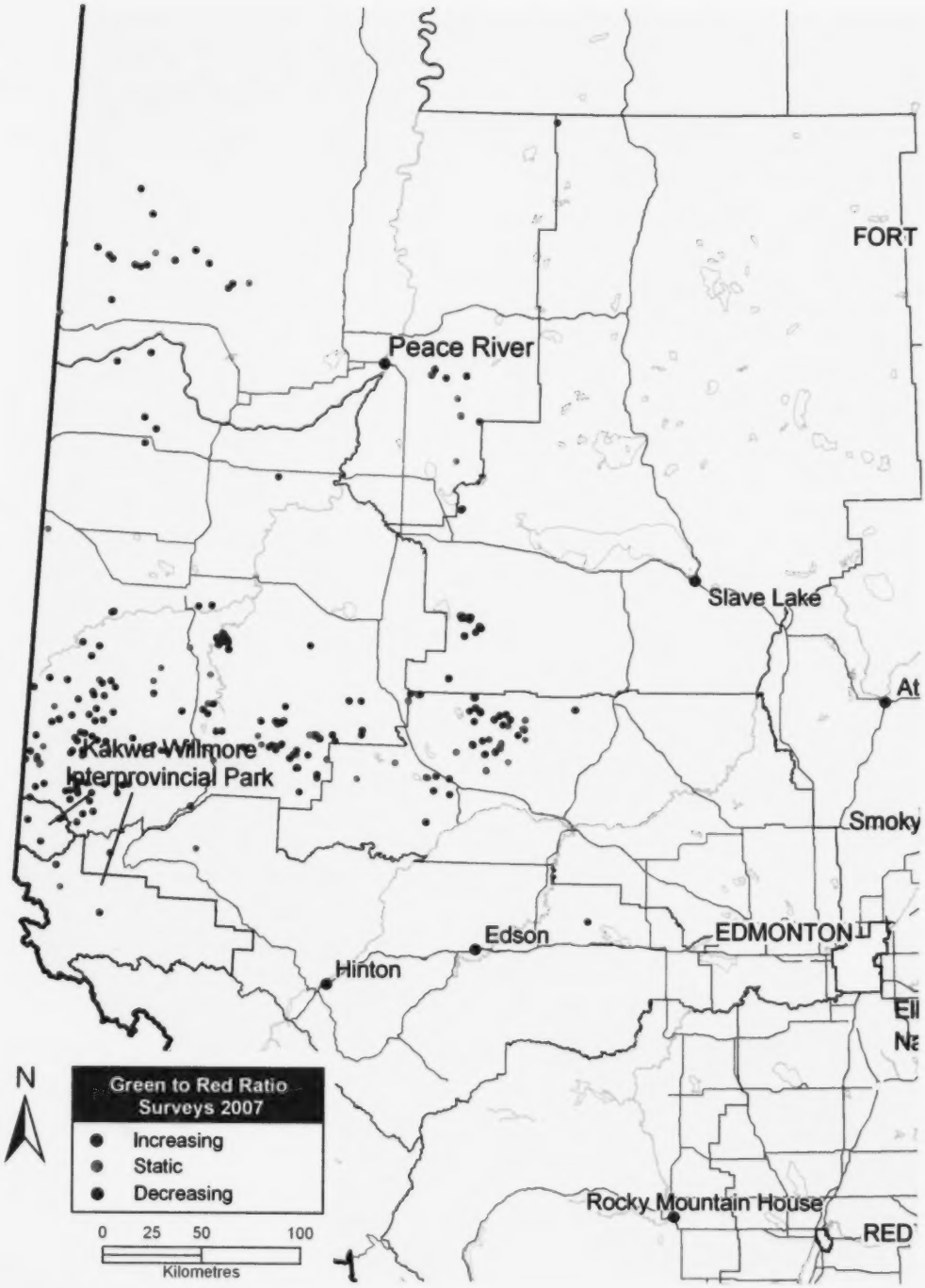


Figure 4
Results of the green:red ratio surveys carried out in northern Alberta in 2007-2008 beetle year.

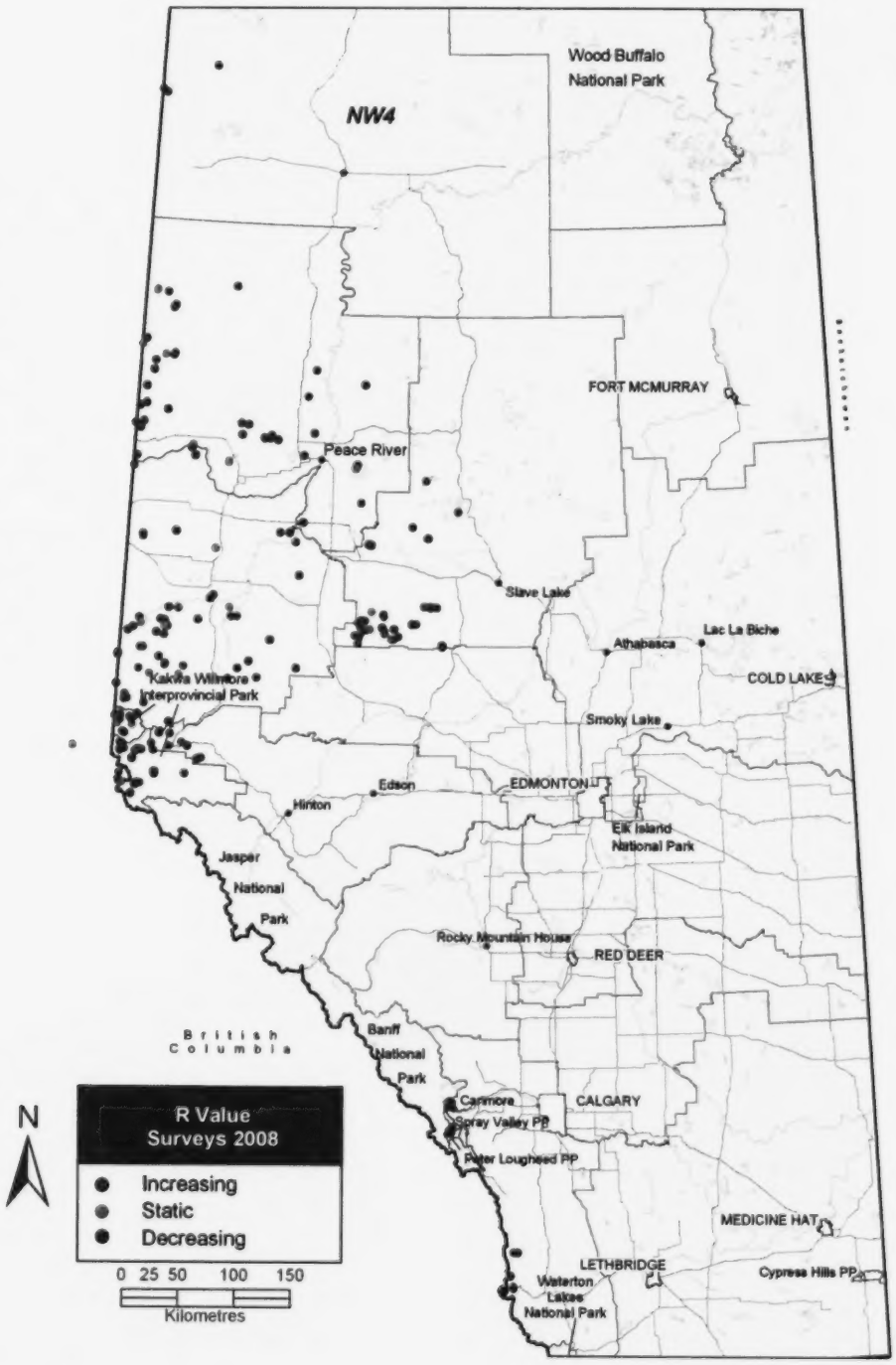


Figure 5
R-value-based MPB population trends forecasted following a survey conducted in 2008 spring in Alberta.

MPB Control Program

Two control strategies were used to achieve the objectives of the provincial mountain pine beetle management program.

I. Beetle-focused Strategy to reduce MPB populations in the short-term

II. Healthy Pine Strategy to reduce the amount of MPB-susceptible pines across the province in the long-term

Refer "Mountain Pine Beetle Management Strategy (Anon. 2007a)" for details on these strategies.

A Geographical Information System (GIS)-supported Decision Support System (DSS) was formulated to prioritize MPB-infested areas for control under the Beetle-Focussed Strategy. This system helps forest managers in deciding which areas are to be treated in order to meet provincial goals. This DSS, based on beetle biology and risk of spread, was used to categorize beetle-infested stands into five levels of priority varying from very low; low; moderate; high to extreme (Anon. 2008a). Each MPB site in the province was ranked based on the DSS. In the Leading Edge Zone (see below) all the sites with extreme, high and moderate rankings were surveyed and treated; in the Holding Zone all the sites with extreme and high rankings were surveyed and treated; in the Inactive Holding Zone SRD did not carry out survey and control action.

For the purpose of controlling MPB, the infested area was divided into three zones as shown in Figure 6. In the Leading Edge Zone, MPB was aggressively controlled by treating small patches, i.e., ≥ 3 infested trees. In southern Alberta, where there was high population success, even single infested trees were treated (Response Level 1). The goal was to suppress MPB populations by treating ≥80% of infested trees in extreme, high and moderate priority areas. In the Holding Zone, Response Level 2 supplemented with Response Level I was used to treat 50-80 per cent of the patches of infestations to keep the population at a static level. In the Inactive Holding Zone, SRD did not carry out MPB control programs. In this Zone, forest companies salvaged MPB-killed timber to minimize losses and sometimes carried out control programs using Response Level 2.

The number of infested trees in an infested patch was taken into account in prioritizing it for control. In the Leading Edge Zone patches of trees with ≥3 trees were prioritized while in the Holding Zone patches of trees with ≥25 trees were prioritized for survey and treatment.

The stand susceptibility index (SSI) – based on the percent, age and size of pines, together with climatic suitability to MPB – was used to classify stand susceptibility to the MPB. SSI was used to prioritize stands for control action.

The R-values were calculated based on surveys carried out in the spring. These R-values were compared provincially to ensure sites with higher R-values received priority in survey and treatment. The highest 25 per cent of R-values were placed in the high classification, the lowest 25 per cent in the low classification and the remaining values were placed in the medium classification.

Figure 6
MPB management zones in Alberta in the 2007-2008 beetle year.

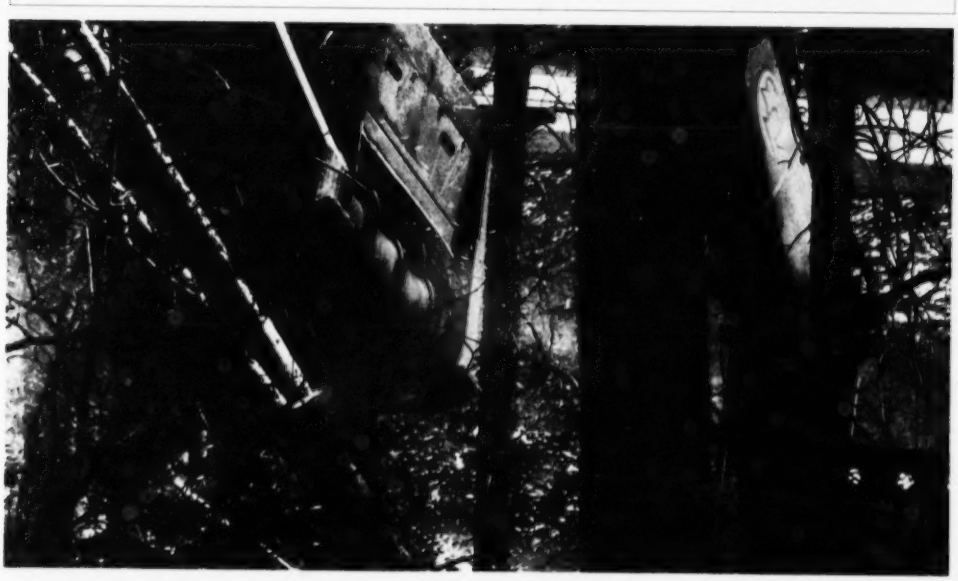
The connectivity, a relative measurement of the proximity of MPB-susceptible stands in a defined area, was also taken into account in determining control action. The areas where MPB consistently undergoes a 2-year life cycle (as determined by MPB degree-day requirement) were excluded from the treated area.

The DSS was further refined in 2008 by making use of the green:red ratios that indicated potential beetle immigration. Those stands with MPB immigration were elevated into higher rankings with high control priority in spite of having low R-values and low numbers of infested trees.

Under Response Level I of the "Beetle-focussed Strategy," 125,137 beetle-attacked trees were cut and burned by SRD in the 2007/08 beetle year; another 9762 trees were cut only. These trees were found at 18,520 sites. The details of this control program are shown in Table 2.

Table 2
The number of beetle-infested trees that were cut and burned under the SRD's MPB control program in 2007-2008 beetle year in Alberta.

Southern Rockies	21,146	795	21,941
Clearwater	77	0	77
Foothills	44,307	419	44,726
Woodlands	803	48	851
Smoky	41,120	1,638	42,758
Lesser Slave	2,697	227	2,924
Peace	11,700	160	11,860
Total	121,850	3,267	125,137



In addition, several municipalities removed 119,909 MPB-infested trees under the SRD grant program. The break-down of this program by each municipality is shown in Table 3.

Table 3
The number of MPB-infested trees controlled by municipalities under SRD's MPB grant program in 2007-2008 beetle year in Alberta.

Forestry area	Municipality	No. of trees controlled 2007-2008	No. of trees controlled 2008-2009
Peace	Town of Fairview	105	--
	MD of Northern Lights	0	--
	County of Clear Hills	0	--
	Town of Peace River	154	508
	Northern Sunrise County	54	--
	MD of Peace and MD of Fairview	738	--
Smoky	South Peace Municipality (Counties of Grande Prairie, Saddle Hills, and Birch Hills; and, Municipal Districts of Greenview and Spirit River)	63,769	117,337
	City of Grande Prairie	634	199
Foothills	Town of Grande Cache	60	62
Woodlands	Woodlands County	0	0
	Town of Fox Creek	12	0
Southern Rockies	MD of Bighorn	4	7
	Town of Canmore	156	787
	MD of Crowsnest Pass	973	717
Lesser Slave	Town of Swan Hills	--	0
	MD of Big Lakes	--	292
Total		**66,659**	**119,909**

Under Response Level 2, several forest companies harvested beetle-infested stands. The volume of pine wood removed during these sanitation harvesting programs is shown in Table 4.

Table 4
The volume of pine wood removed by forest companies under sanitation harvest programs to control the MPB in 2007-2008 beetle year in Alberta[1].

Ainsworth	2,604
Blue Ridge Lumber Ltd.	47,442
Boucher Brothers	32,167
Canadian Forest Products Ltd.	578,306
Columbia Pole	213
Daishowa-Marubeni International Ltd	645
Export Tembec	14,690
Martin Daniel	4,277
Millar Western Industries Ltd (Fox Creek)	118,676
Peachy, David	2,684
Raxton, Colin	5,389
Spray Lakes sawmills (1980) Ltd.	2,134
Weyerhauser Canada Ltd. (Grande Prairie)	1,458,466
Zavisha	73,211
Total	**2,340,904**

Protection of Genetic Plantations

In June 2008, 256 Verbenone pouches were installed in 15 MPB-susceptible pine genetic trials located across the province. In addition, eight pheromone-baited Lindgren funnel traps were installed at the Alberta Tree Improvement and Seed Centre and two traps were installed at a genetic plantation in Brooks to detect MPB. These traps and detection surveys carried out at 35 genetic trials in 2008 did not reveal any signs or symptoms of MPB attacks. In 2008, under the MPB pine preservation program, seeds were collected from whitebark and limber pine plantations.

[1] This is the sum total of both infested and healthy pines harvested together from MPB-infested stands that were removed under sanitation harvesting.

In summary, the results of the 2007-2008 MPB control program show that the Forest Health Program met Strategy 3.2 under SRD Business Goal 3, i.e., to implement aggressive actions to maintain health and manage mountain pine beetle in cooperation with industry, municipal and federal governments. All the infested trees with high DSS rankings were removed under Response Level 1. In addition, 2.3 million cubic metres of pine wood were removed from the infested stands under Response Level 2 (Table 4). The long distance aerial dispersal bait program helped to detect, in advance, the occurrence of MPB in the current MPB outbreak in previously un-infested Clearwater Area. The dispersal baits also indicated that MPB eastward dispersal did not materialise in 2008. Thus SRD was proactive in controlling this infestation. These initiatives helped to protect pines along the Eastern Slopes and prevented eastward spread of beetles. No MPB attacks were reported in the monitored genetic plantations of the province in 2008.

Outlook for 2008-2009

Figure 7 shows results of the long-distance aerial dispersal baiting program carried out in July-September 2008. The beetle infestations are expected to persist in north and east Peace Area; west Lesser Slave Area; west Foothills Area and in the Clearwater Area where long distance aerial dispersal bait program indicated new beetle hits. In particular, expansion of MPB is expected in 2008-2009 in the Clearwater Area. No MPB infestation is expected in the Lac La Biche Area. Thus, further eastward expansion of MPB infestation is not expected in the 2008-2009 beetle year.

Figure 8 shows spatial distribution of pines with red crowns potentially caused by MPB that was recorded during aerial surveys carried out in fall 2008. Based on these results the MPB infestations are expected to be lower in 2008-2009 in the Lesser Slave, parts of Smoky, Woodlands and Foothills areas. These lower infestations coincide with the areas where aggressive control action was taken to manage the MPB in 2007-2008 year. However, more MPB infested trees are expected in 2008-2009 in parts of north and east Peace Area and in Willmore Wilderness Park; the number of infested trees in the rest of the Peace Area will be recorded based on satellite imagery. The MPB infestation is expected to increase in the Southern Rockies Area.

Overall, MPB infestations are expected to decline in most of the Leading Edge Zone where control action was taken in 2007-2008. Infestations are expected to either increase or remain static in 2008-2009 in east and north Peace Area and in the Southern Rockies Area. New infestations are expected to occur in the Clearwater Area in 2008-2009. No MPB infestations are expected in the Lac La Biche Area in 2008-2009.

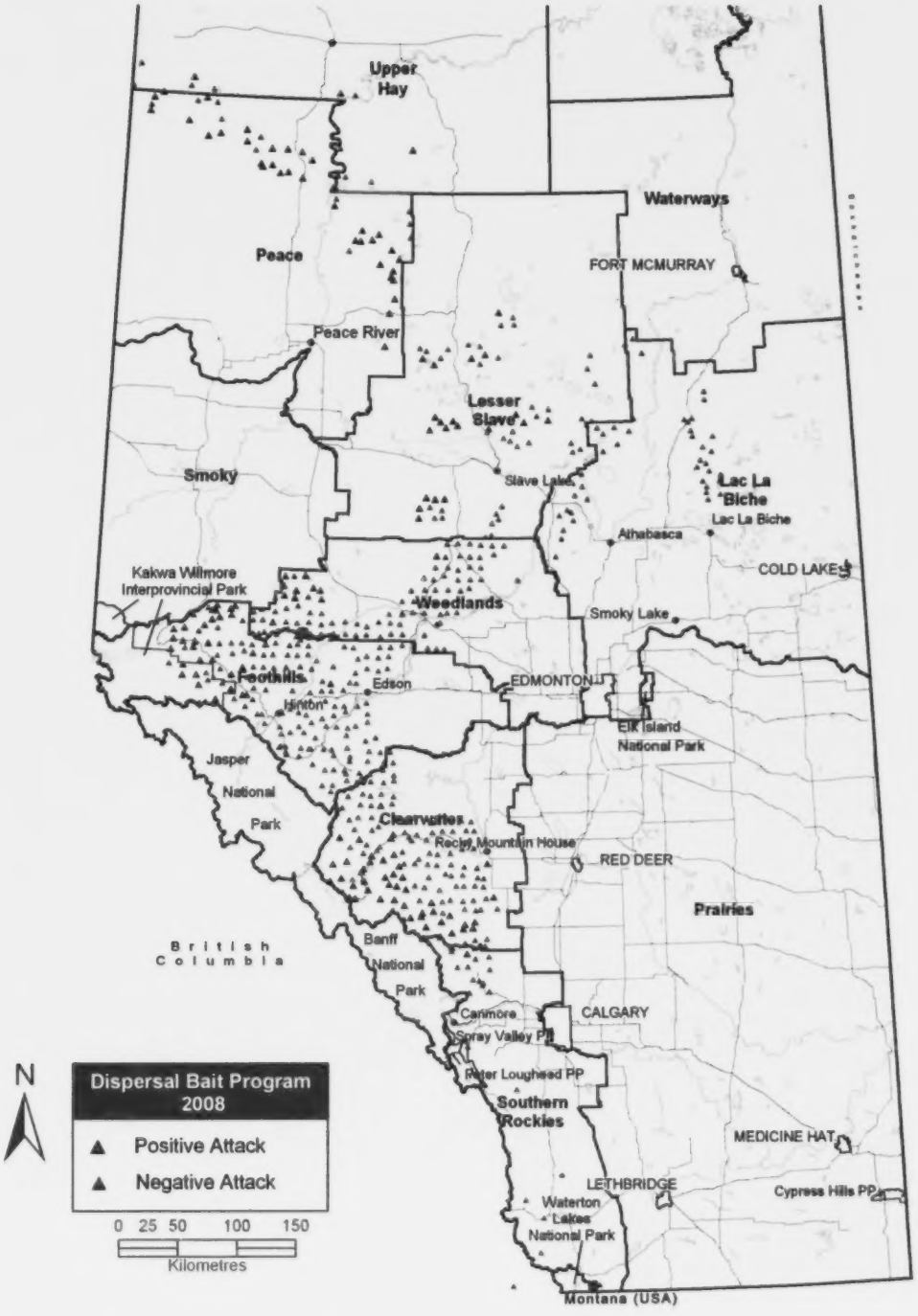


Figure 7
Results of the MPB long distance aerial dispersal baiting carried out from July to September 2008 in Alberta.

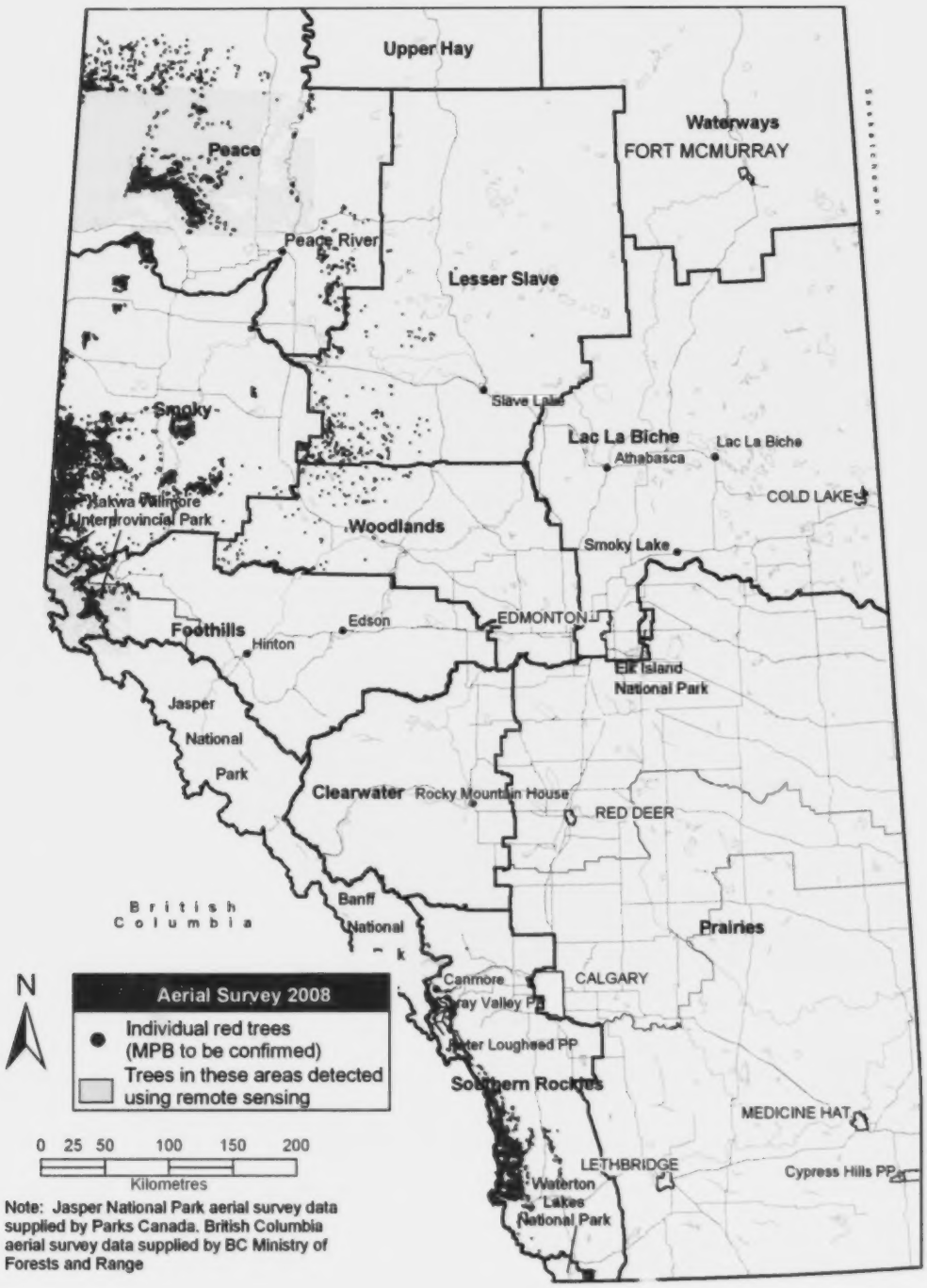


Figure 8
Results of the fall 2008 heli-GPS surveys showing locations of pines with red crowns suspected of mountain pine beetle attacks in Alberta.

Spruce Budworms

Aerial Surveys

Each year, Forest Health Officers and/or Technicians carry out aerial surveys to monitor extent and severity of spruce budworm infestations on forested Crown land. The goals of this program are:

1. To keep a historical record of these infestations; and,

2. To make an assessment on the need to take control actions if spruce budworm infestations threaten the management objectives of the affected lands.

The aerial survey methods used in these surveys are described in "Forest Health Aerial Survey Manual" (Ranasinghe and Kominek, 1999).

The results of these surveys are shown in Figure 9 and in Table 5.

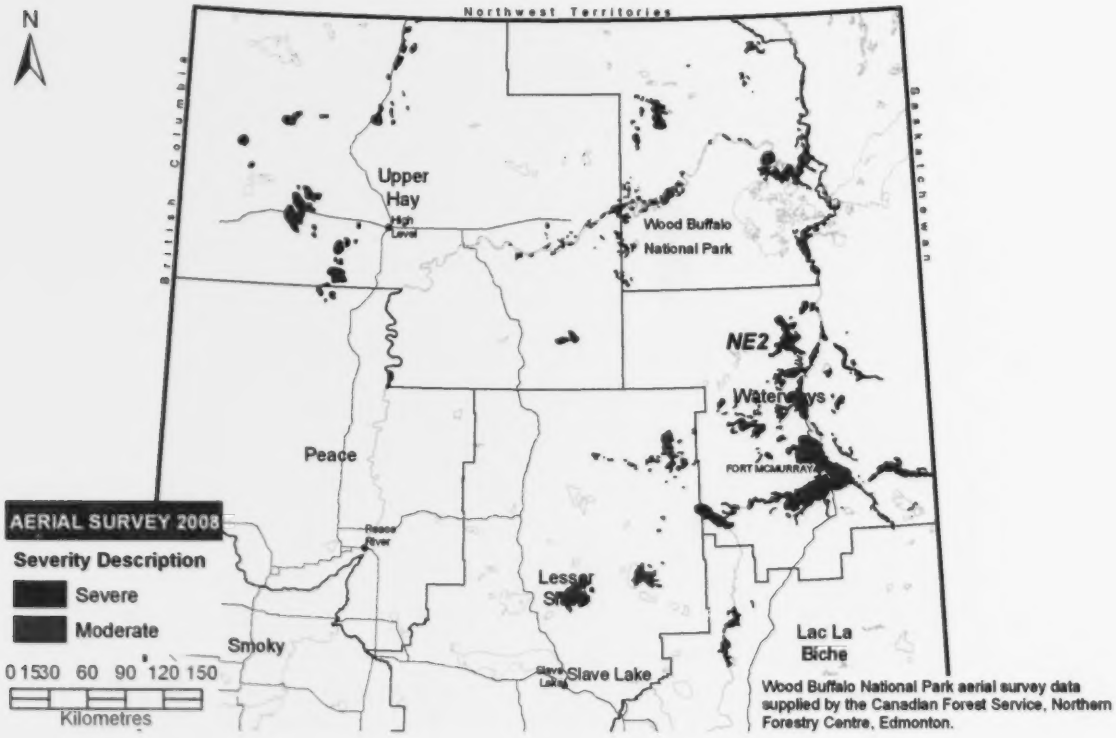


Figure 9
Spatial distribution of aerially visible spruce budworm defoliation on forested Crown land surveyed in Alberta in 2008.

Figure 8
Results of the fall 2008 heli-GPS surveys showing locations of pines with red crowns suspected of mountain pine beetle attacks in Alberta.

Spruce Budworms

Each year, Forest Health Officers and/or Technicians carry out aerial surveys to monitor extent and severity of spruce budworm infestations on forested Crown land. The goals of this program are:

1. To keep a historical record of these infestations; and,

2. To make an assessment on the need to take control actions if spruce budworm infestations threaten the management objectives of the affected lands.

The aerial survey methods used in these surveys are described in "Forest Health Aerial Survey Manual" (Ranasinghe and Kominek, 1999).

The results of these surveys are shown in Figure 9 and in Table 5.

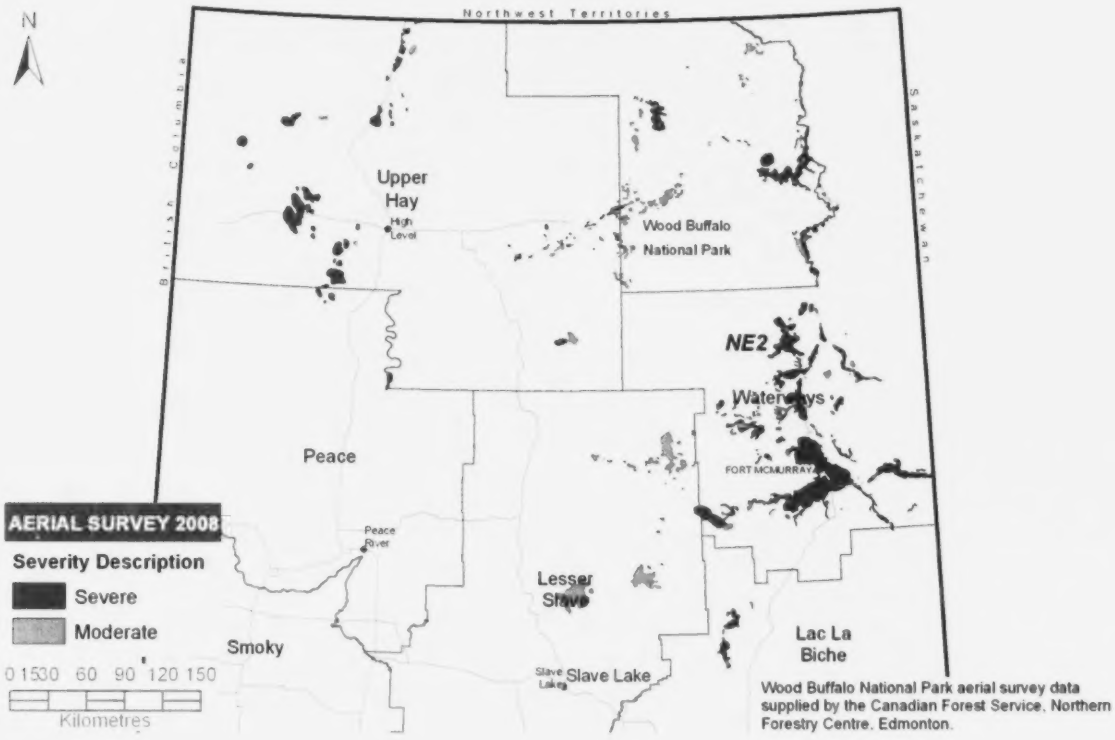


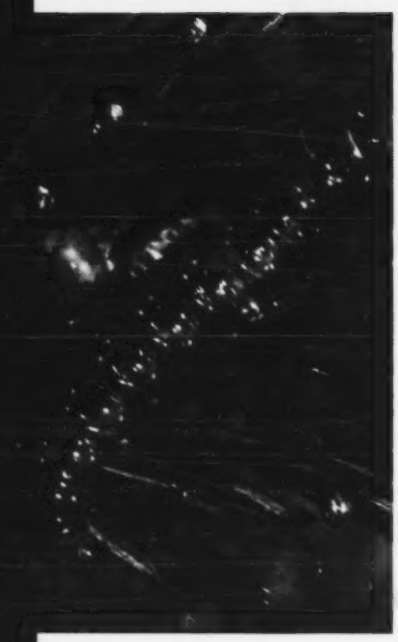
Figure 9
Spatial distribution of aerially visible spruce budworm defoliation on forested Crown land surveyed in Alberta in 2008.

Overall, spruce budworm defoliated area in the province increased by 47 per cent in 2008 compared to that in 2007 (Table 5). There was a slight decrease in the area with moderate defoliation but severely defoliated area more than doubled between 2007 and 2008 (Table 5). This is mainly due to an increase in the defoliated area in northwest Alberta, which experienced a resurgence of budworm infestations (Figures 9 and 10).

Table 5
The number of hectares of spruce budworm defoliation by severity categories recorded during aerial surveys carried out in Alberta[1], 2007-2008.

Net	36,607	35,688	72,295	48,378	112,030	160,408
Gross[2]	18,515	17,948	36,463	0	0	0
Total	55,122	53,636	108,758	48,378	112,030	160,408
Change[3]	--	--	--	-12%	109%	47%

1 Excluding Wood Buffalo National Park
2 Defoliated area in non-inventoried land
3 Percent increase in total defoliated area compared to the corresponding value in 2007



In northeast Alberta, there was a modest increase in the total defoliated area; however, severely defoliated area increased substantially (Figure 10). If this trend continues, volume growth in the stands that have been severely defoliated for three or more consecutive years will begin to slow down (Volney 1993). Some of these stands were defoliated for longer than 7 years during the previous outbreak that collapsed in 2005 and show tree kill (Tom Hutchison, personal information). Spruce budworm control action may be warranted if infested trees in this area that represent mid-term wood fibre supply for industry need to be kept alive.

In northwest Alberta, there was a substantial increase in the defoliated area in 2008 compared to that in 2007 (Figure 12). The severely defoliated area also increased substantially during this period. This increase is attributable to an increase in the defoliated area in the Upper Hay Area. The current pattern of defoliation in this Area is similar to what occurred at the early stages of the previous spruce budworm outbreak from 1987-2003. Since then, the defoliated area has increased yearly (Figure 11). In the aftermath of the mountain pine beetle infestation, white spruce will be important as a source of mid-term wood fibre supply to industry in this area. If this increasing spruce budworm outbreak trend continues management action may have to be taken to protect the affected spruce stands.

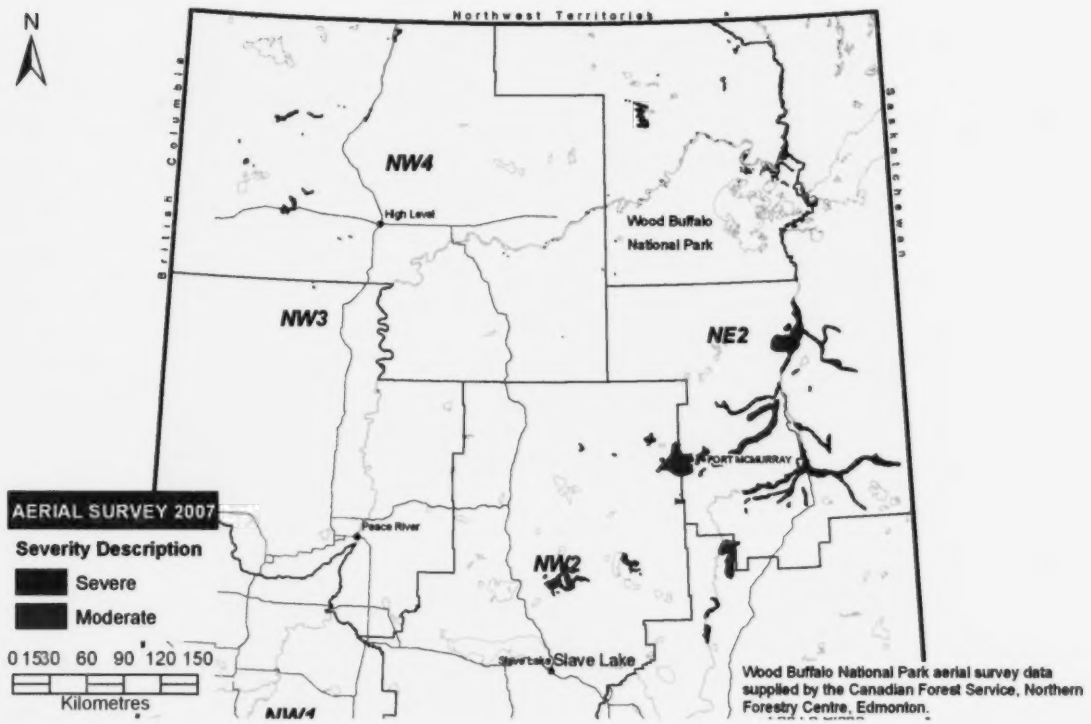


Figure 10
Spatial distribution of aerially visible spruce budworm defoliation on forested Crown land surveyed in Alberta in 2007.

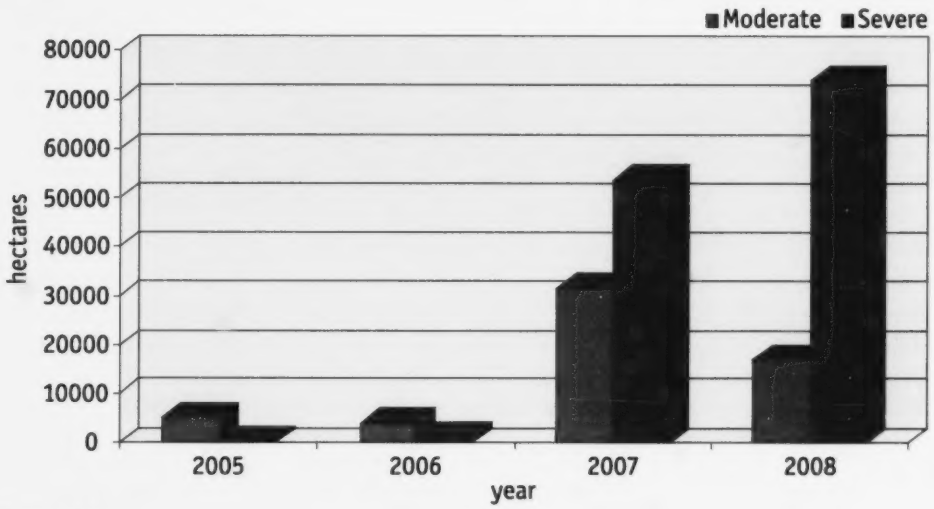


Figure 11
Number of hectares with moderate or severe spruce budworm defoliation in northeast Alberta, 2005-2008.

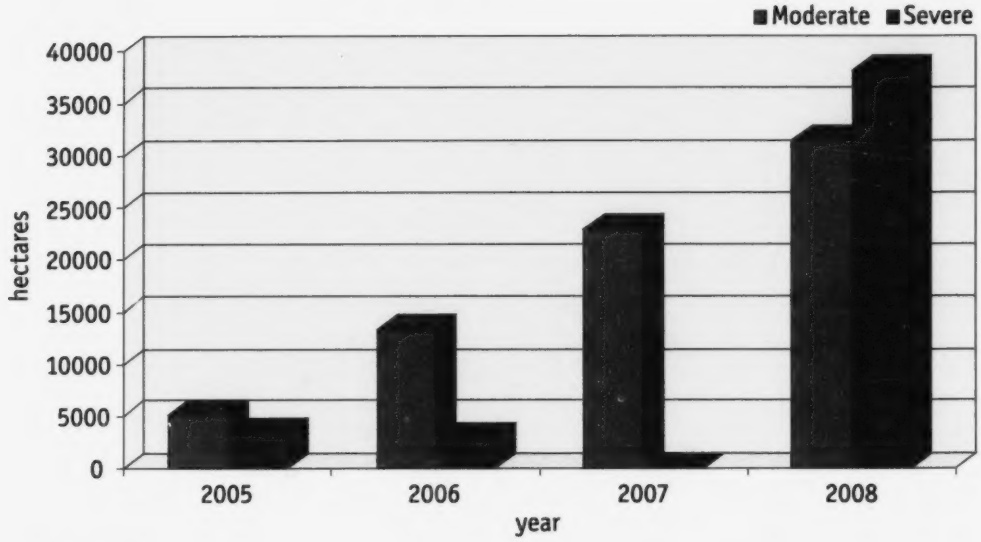


Figure 12
Number of hectares with moderate or severe spruce budworm defoliation in northwest Alberta, 2005-2008.

No defoliation due to the spruce budworm was reported from southwest Alberta in 2008.

Forecast for 2009

Multipher-I® traps baited with synthetic female spruce budworm sex pheromone lures are used annually to monitor male budworm moth population in strategically selected sites across the forested Crown land. The procedure for deploying these traps is described in the Spruce Budworm Manual (Ranasinghe and Kominek, 1998). In 2008, two traps with lures were placed at each of the 144 trap sites across the province. Figure 13 shows the results of this survey.

Based on the pheromone-baited trap catches, most of the currently spruce budworm defoliated areas in the Lac La Biche Area and the Waterways Area are expected to have new outbreaks in 2009. Similar trend is seen in the Upper Hay Area where risk of new outbreaks occurring in 2009 is moderate to high. Risk of 2-year cycle budworm outbreaks occurring in 2009 is low at higher elevations in the Foothills, Clearwater and Southern Rockies areas. The male moth trap catches of the two-year cycle budworm have been increasing in recent years. There is a moderate risk of aerially visible defoliation occurring in 2010 at the sites that had high trap catches in 2008. Risk of new budworm outbreaks occurring in the other Areas in 2009 is nil to low (Figure 13).

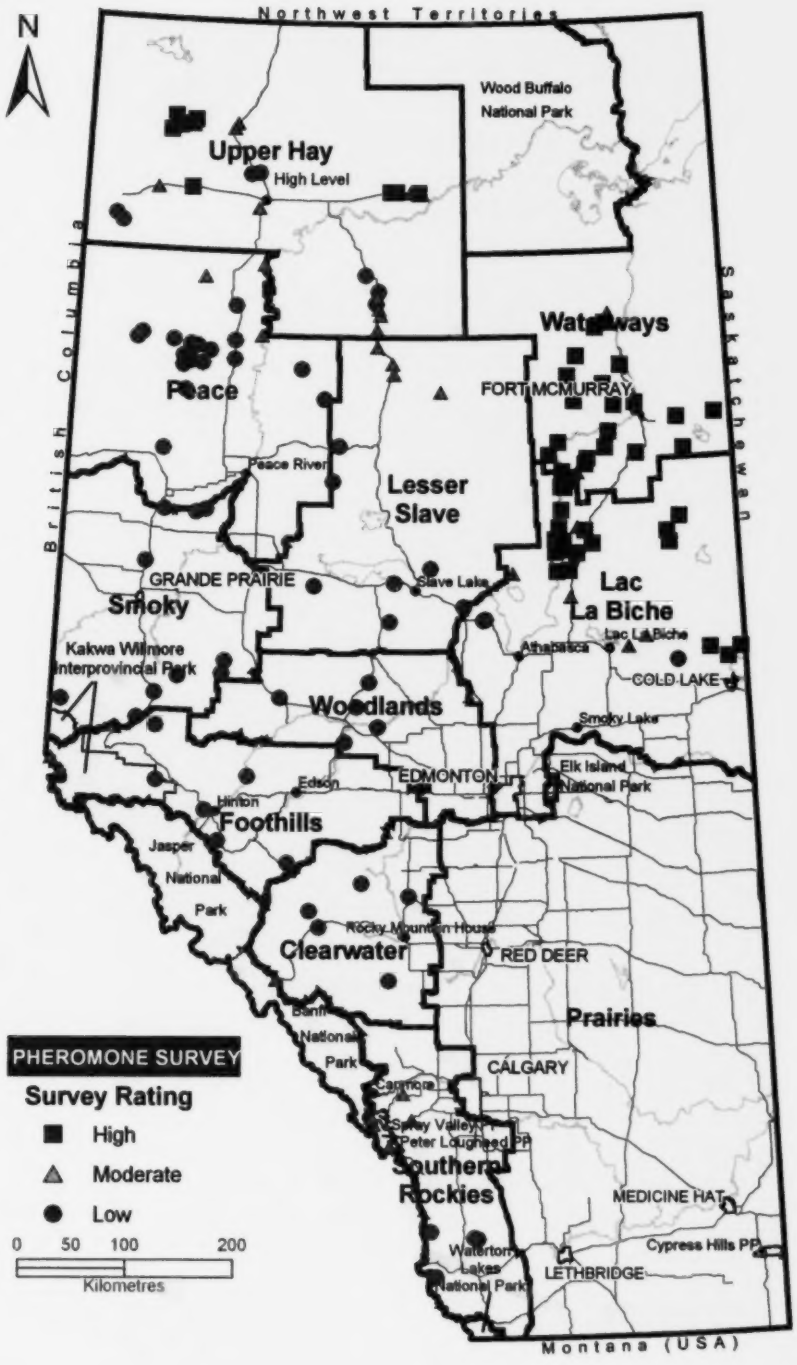


Figure 13
Forecast on risk of new spruce budworm outbreaks occurring in 2009 in Alberta based on male moth catches in 2008 in Multipher–I traps baited with pheromone lures.

Western Spruce Budworm

Figure 14 shows the results of the 2008 aerial overview survey on the extent of western spruce budworm defoliation in the Porcupine Hills in the Southern Rockies Area. In 2008, the defoliated area increased by 27 per cent compared to that in 2007 and covered 22,471 hectares. Most (91%) of this defoliation was moderate and the remainder (9 per cent) was light in intensity. In 2008, this infestation spread further west and south of Porcupine Hills.

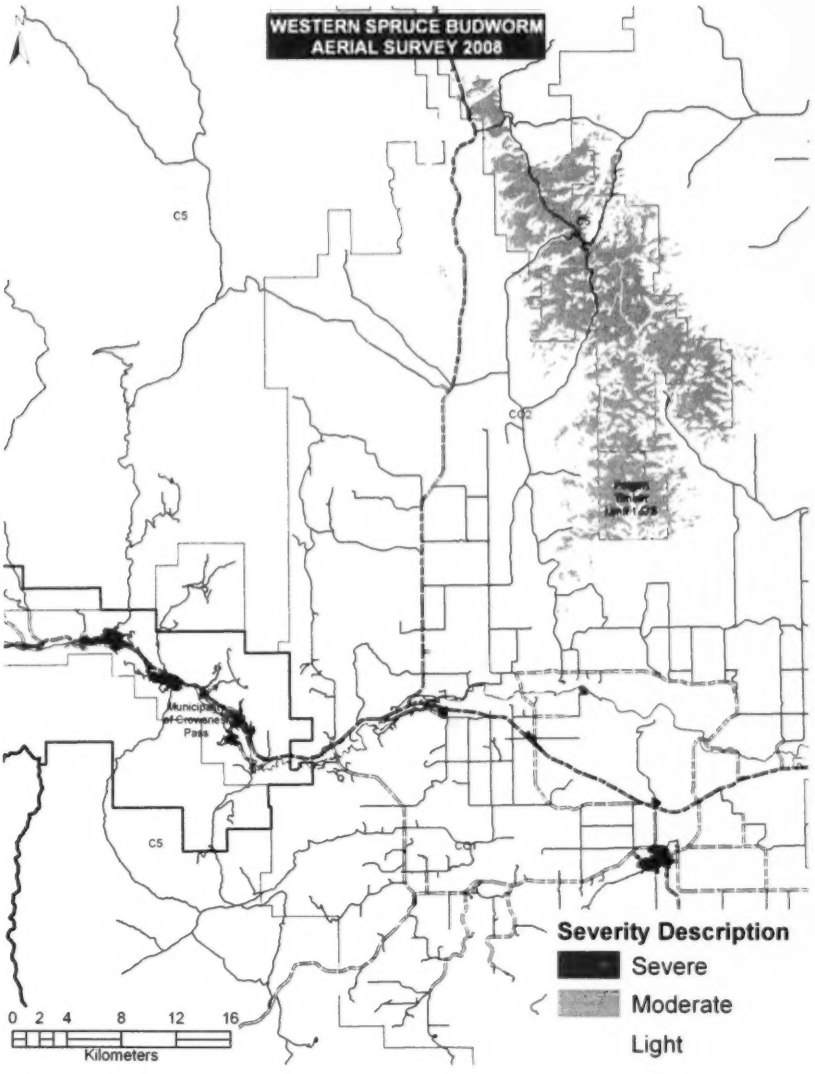


Figure 14
Spatial distribution of aerially visible western spruce budworm defoliation by severity categories in southwest Alberta, 2008.

Western Spruce Budworm

Figure 14 shows the results of the 2008 aerial overview survey on the extent of western spruce budworm defoliation in the Porcupine Hills in the Southern Rockies Area. In 2008, the defoliated area increased by 27 per cent compared to that in 2007 and covered 22,471 hectares. Most (91%) of this defoliation was moderate and the remainder (9 per cent) was light in intensity. In 2008, this infestation spread further west and south of Porcupine Hills.

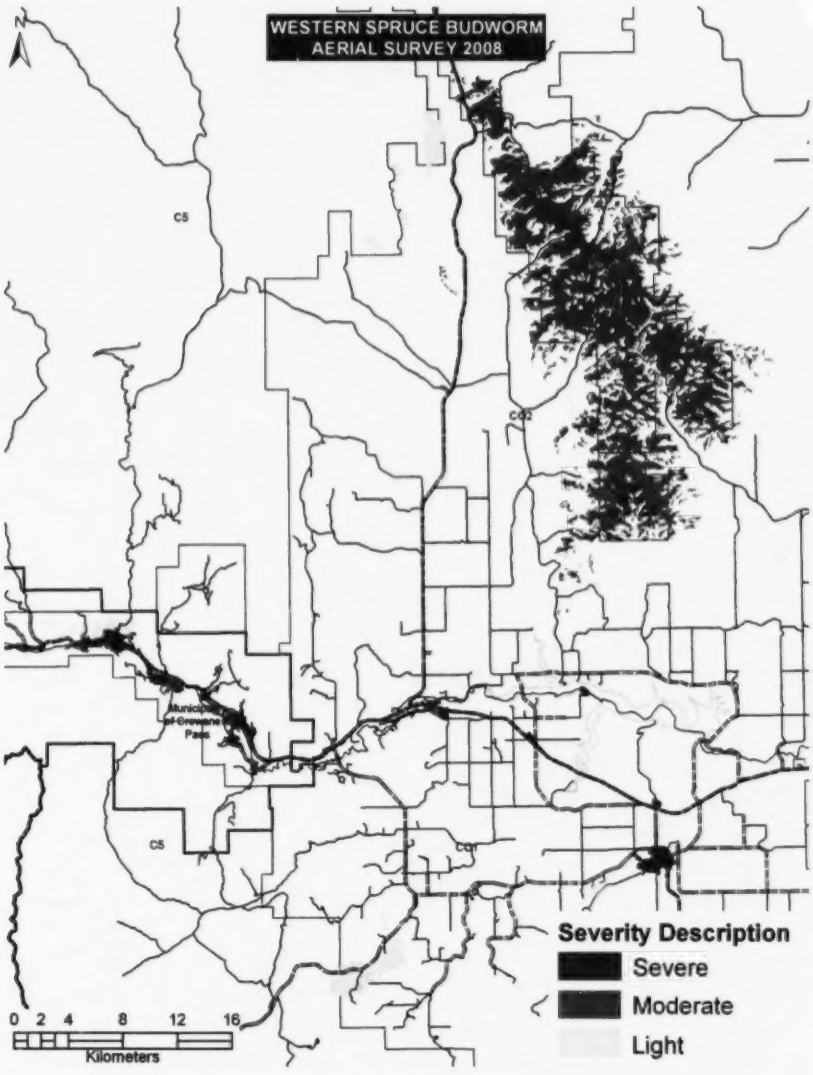


Figure 14
Spatial distribution of aerially visible western spruce budworm defoliation by severity categories in southwest Alberta, 2008.

British Columbia's defoliation intensity forecast standards were used in 2007 to forecast western spruce budworm defoliation severity expected in 2008 in Alberta. That forecast called for severe defoliation in 2008. However, defoliation observed in 2008 was of moderate intensity. This indicates a need to re-assess the current defoliation severity forecasting standards for this pest in Alberta.

To predict the intensity of defoliation expected in 2009, twelve plots that were established in the infested area in 2007 were sampled for egg masses by following the procedure described in Ranasinghe (2007). The results of this survey are shown in Figure 15.

The survey results indicated lower egg mass counts in most of the plots compared to those recorded in 2007 (Anon. 2007c). Thus, the infested area is expected to have light to moderate defoliation in 2009.

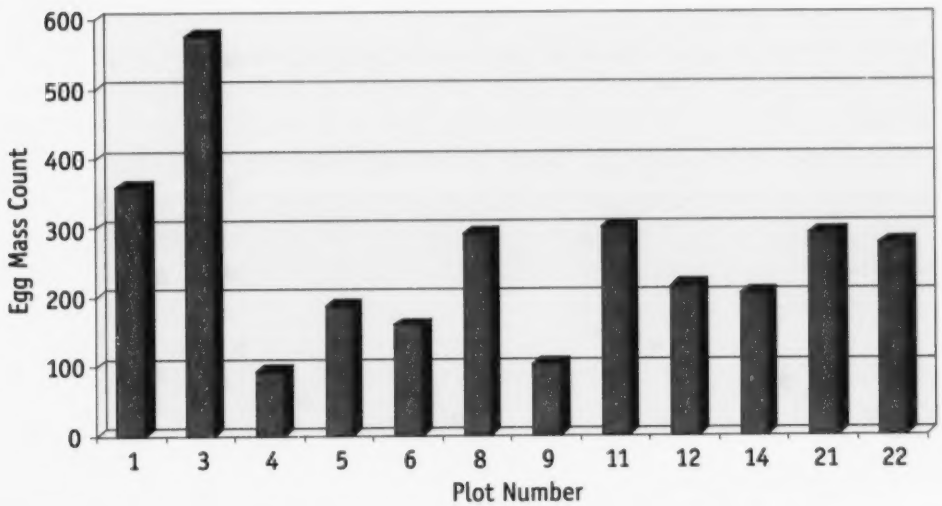
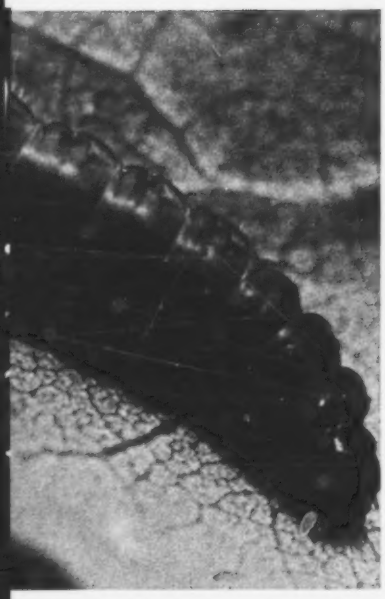


Figure 15
Western spruce budworm egg mass counts in southwest Alberta, 2008.



Aspen Defoliators

Forest Health Officers and/or Technicians carry out annual aerial overview surveys to record the area over which aspen defoliation is scattered and to estimate the intensity of defoliation by severity categories. The survey procedure described in the "Forest Health Aerial Survey Manual" (Ranasinghe and Kominek, 1999) was modified, to include the use of a tablet personal computer linked to a global positioning system.

The objective of this program is to keep a historical record of aspen defoliation in the province.

Table 6 and Figure 16 show the results of these surveys. The 2008 aspen defoliation in Alberta was attributed to the forest tent caterpillar, large aspen tortrix and the Linden looper; aspen serpentine leafminer defoliated a substantial area in Wood Buffalo National Park (Roger Brett, pers. communication). Aspen defoliation in the surveyed area was scattered over an estimated area of 2,962,236 hectares. This is a 9 per cent drop in extent compared to the 3,253,619 hectares defoliated in 2007 (Figure 17). Table 7 shows severity categories of aspen defoliation by causative pest species.

Table 6
Forest insect caused aspen defoliation by severity categories in Alberta[1], 2008.

Location	Gross Area of Defoliation (ha)			
	Light	Moderate	Severe	Sub-Total
Northeast AB	264,860	328,648	847,478	1,440,986
Northwest AB	779,566	307,160	91,977	1,178,703
Southwest AB	114,816	99,079	21,294	235,189
Sub- Total	1,159,242	734,887	960,749	
Grand Total		**2,854,878**		

[1] Excluding Wood Buffalo National Park and Prairies

Table 7
Severity categories of aspen defoliation in Alberta[1] by causative pest species, 2008.

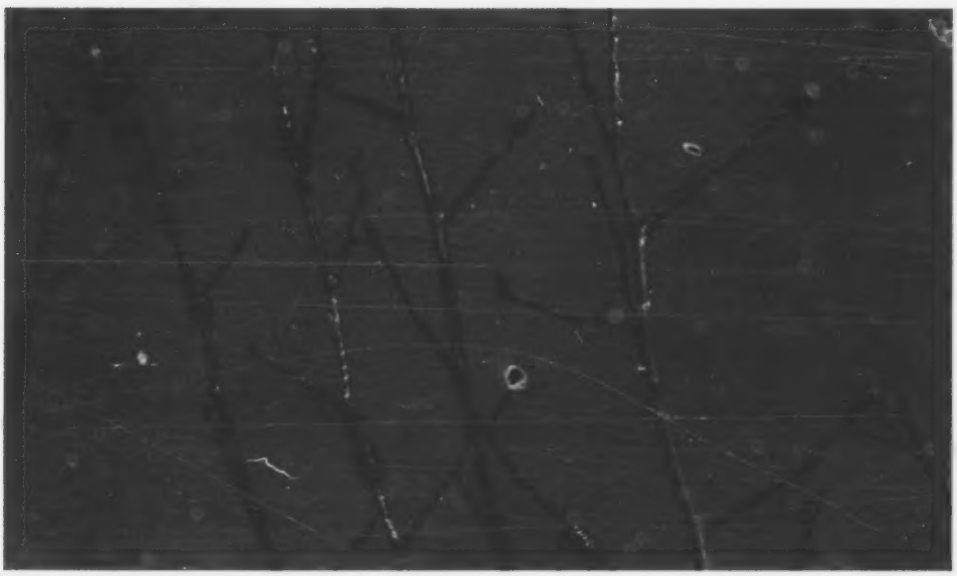
Aspen Serpentine Leafminer	--	97,357	--	97,357
Bruce Spanworm	615,334	106,578	21,115	743,027
Forest Tent Caterpillar	320,702	299,423	894,960	1,515,085
Large Aspen Tortrix	233,206	328,886	44,675	596,768
Total	**1,169,242**	**832,244**	**960,750**	**2,962,236**

[1] Including Wood Buffalo National Park and Prairies

There was some resurgence of aspen defoliation in the Upper Hay Area where defoliation increased in intensity and extent. In most of the other areas, aspen defoliation decreased in severity and extent compared to those reported in 2007. This indicates a possible beginning of the collapse of this infestation.

Outlook for 2009

A limited forest tent caterpillar egg mass survey was carried out in 2008 fall by Tom Hutchison, the Regional Forest Health Officer of the Athabasca and Waterways areas. The survey procedure is described in Ranasinghe (2007b). The results of this survey indicated that light to moderate defoliation is expected to occur in the Waterways Area in 2009.



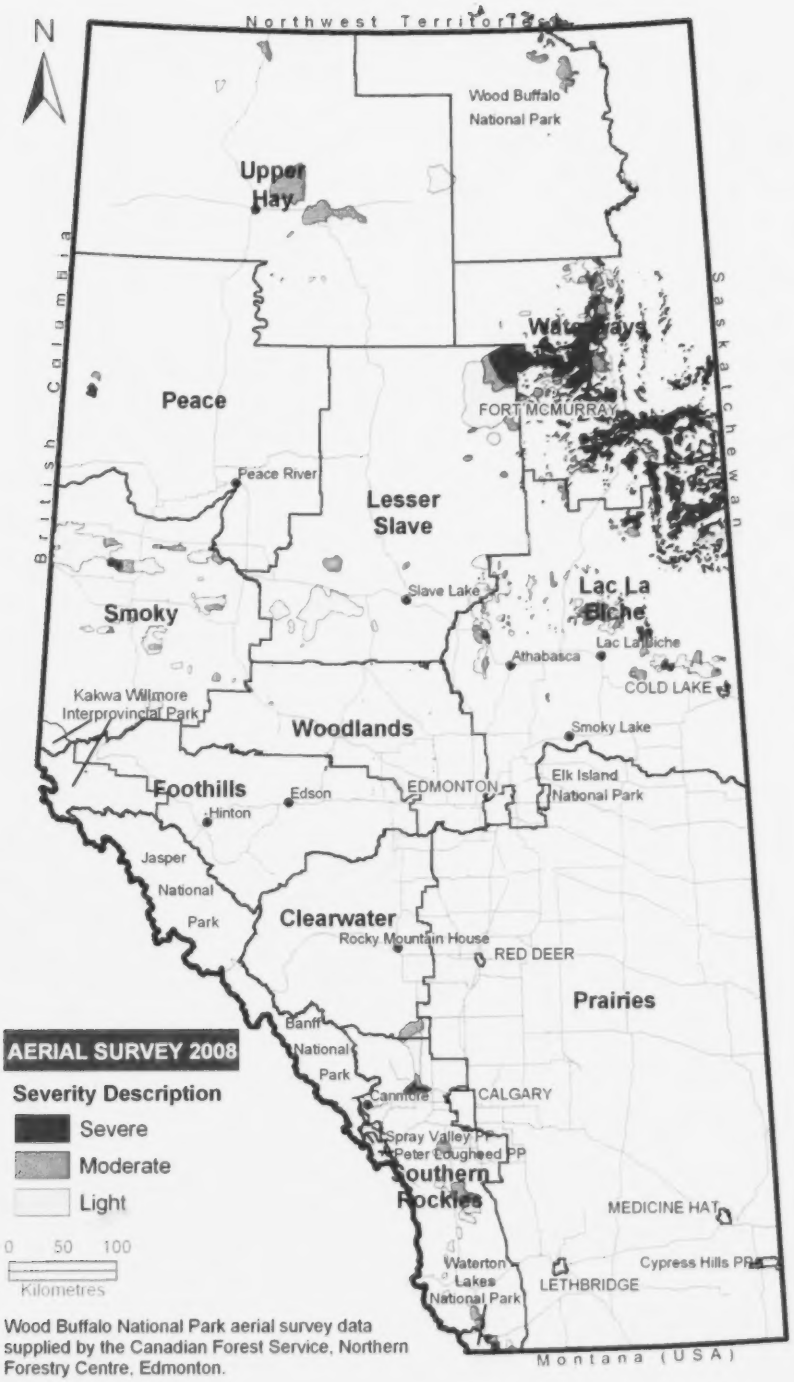


Figure 16
Spatial distribution of aerially visible aspen defoliation by severity categories in the areas surveyed in 2008 in Alberta.

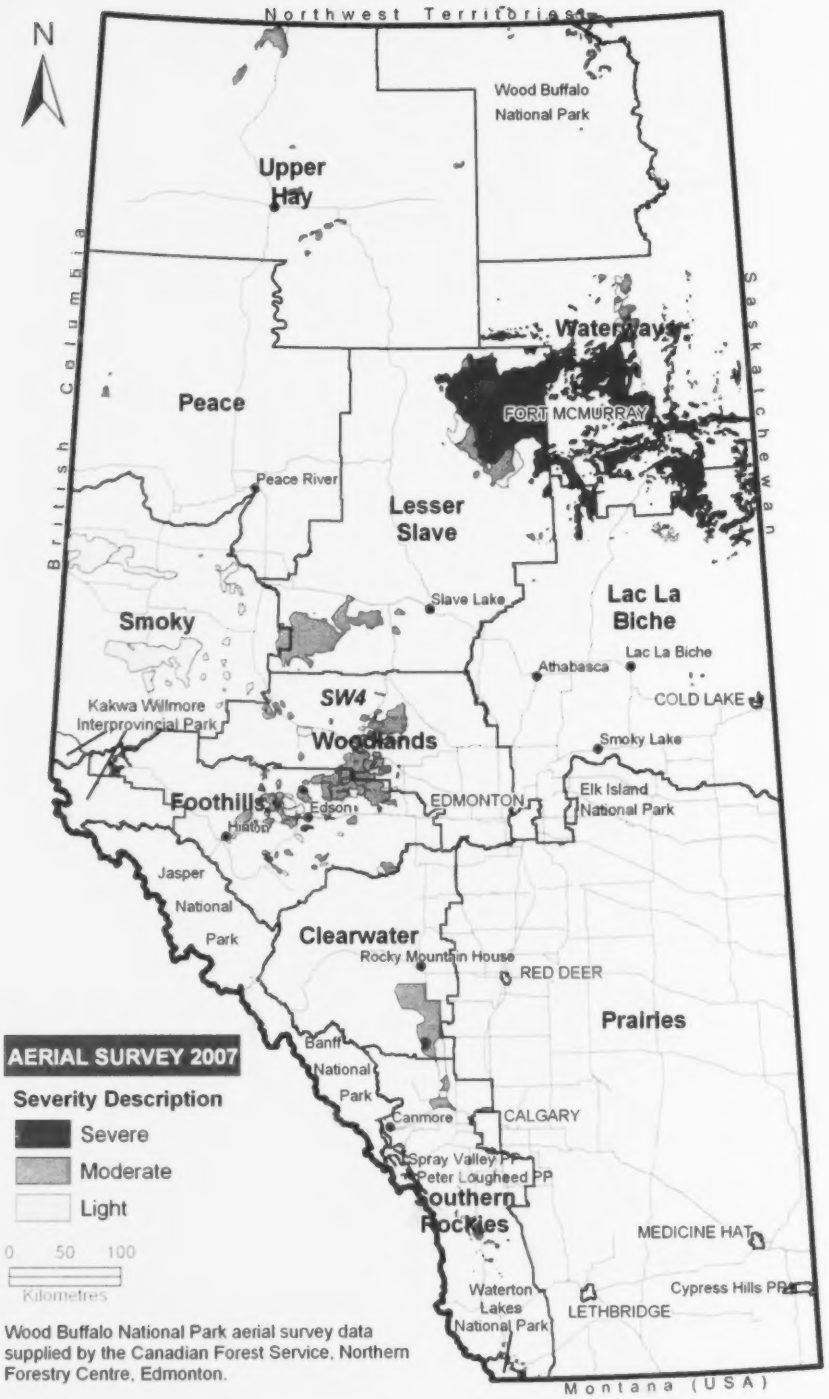


Figure 17
Spatial distribution of aerially visible aspen defoliation by severity categories in the areas surveyed in 2007 in Alberta.

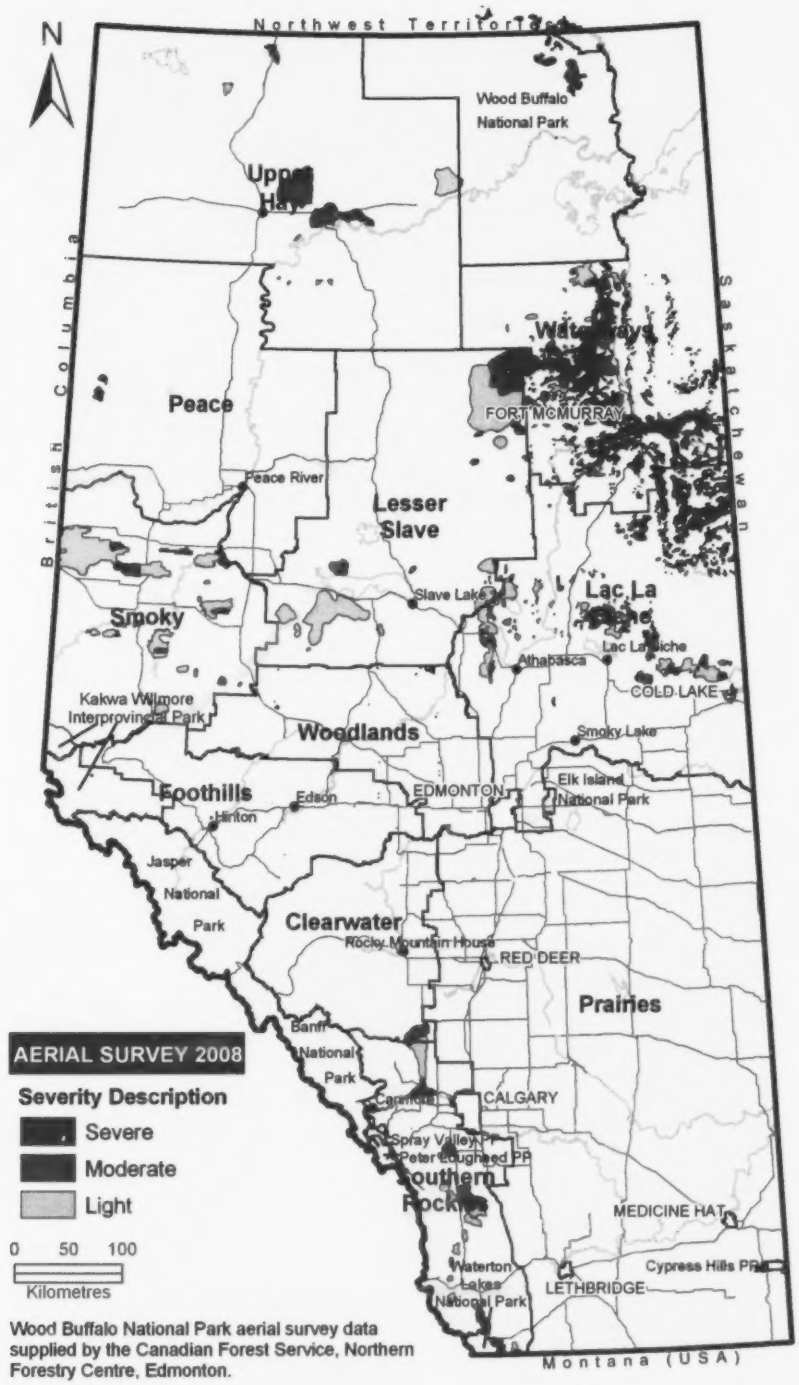


Figure 16
Spatial distribution of aerially visible aspen defoliation by severity categories in the areas surveyed in 2008 in Alberta.

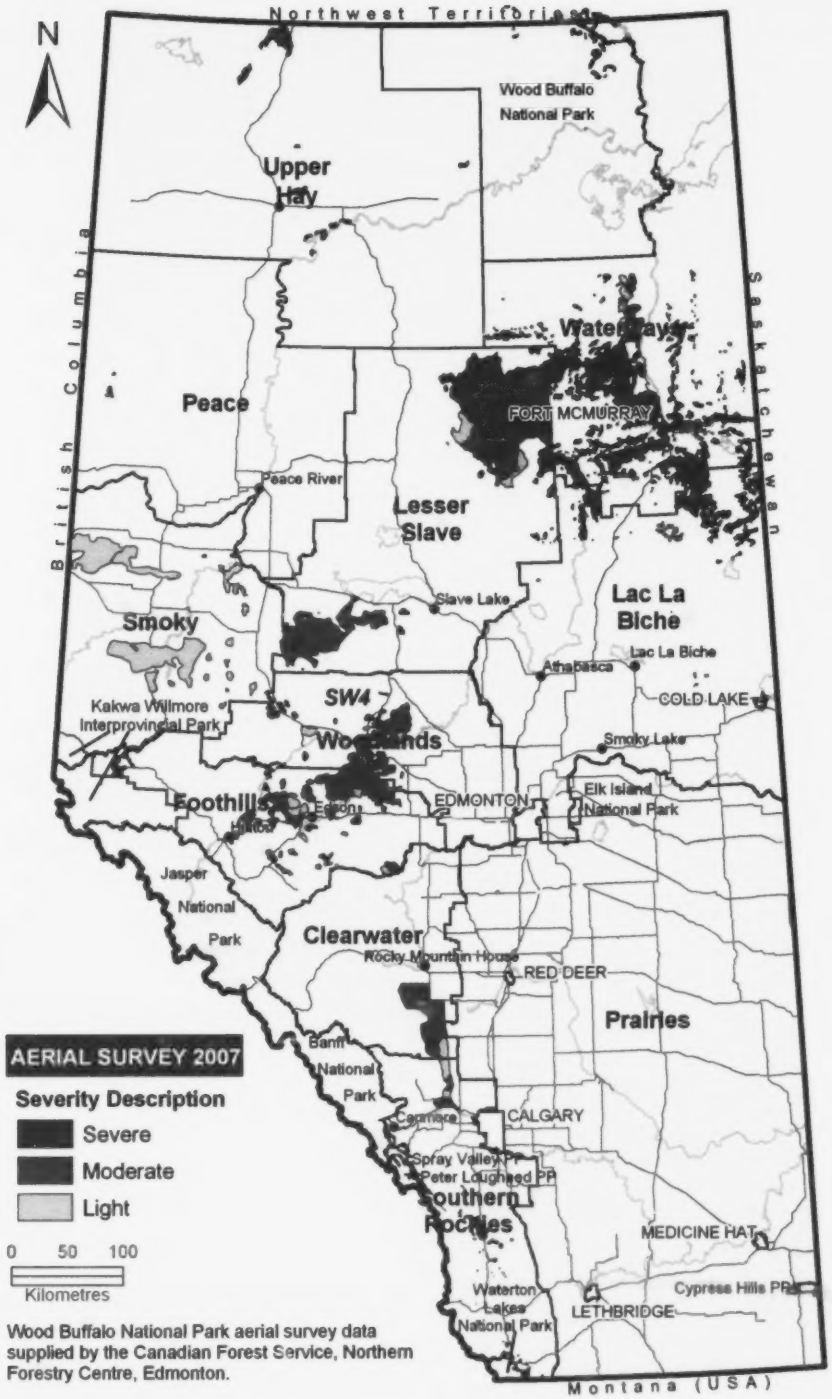


Figure 17
Spatial distribution of aerially visible aspen defoliation by severity categories in the areas surveyed in 2007 in Alberta.

Invasive Alien Plant Species

In 2008, forest health staff surveyed the extent and severity of invasive plant infestations within Alberta's forested area. Based on a 10-year survey record it is clear that vast majority (approx 80 per cent) of all invasive plants observed were located on, or adjacent to industrial dispositions.

Percentage of vacant vs. occupied land sites surveyed in 2008:

Industrial Occupant	78%
Other Occupant	12%
Vacant	10%

In 2008, a total of 2530 sites were surveyed. Almost all of these were infested with invasive plants.

Frequency of invasive plant occurrences in 2008:

Sites with invasive plants	96%
Sites without invasive plants	4%

Perennial sow-thistle, Canada thistle and scentless chamomile were the predominant invasive plant species in the province in 2008 (Table 8).

Primarily herbicide treatments and hand-picking were the two methods used in 2008 to control invasive plants on vacant public land and at SRD facilities. In addition, SRD participated in and/or facilitated a small number of cooperative control projects with industry and municipalities to control large, multi-jurisdictional infestations.

This year, for the first time, survey and control information collected by forest health staff was entered into Sustainable Resource Development's GLIMPS (Geographic Land Information Management and Planning System) database.

Figures 18 - 27 show the locations of positive survey sites of 10 prominent invasive plant species in 2008 in relation to historic survey information.

Table 8
Relative frequency of occurrence and area affected by invasive plant species in Alberta in 2008.

Perennial Sow-thistle	30%	1,267
Canada Thistle	23%	367
Scentless Chamomile	12%	157
Tall Buttercup	9%	1,306
Common Tansy	3%	83
Common Toadflax	<1%	45
Dog Mustard	<1%	14
Spotted Knapweed	<1%	10
Blueweed	1%	6
Leafy Spurge	<1%	5
White Cockle	<1%	2
Bladder Campion	<1%	2
False Cleavers	1%	<1
Dalmatian Toadflax	<1%	<1
Hound's Tongue	<1%	<1
Orange Hawkweed	<1%	<1
Stinkweed	<1%	<1
Annual Sow-Thistle	<1%	<1
Downy Brome	<1%	<1

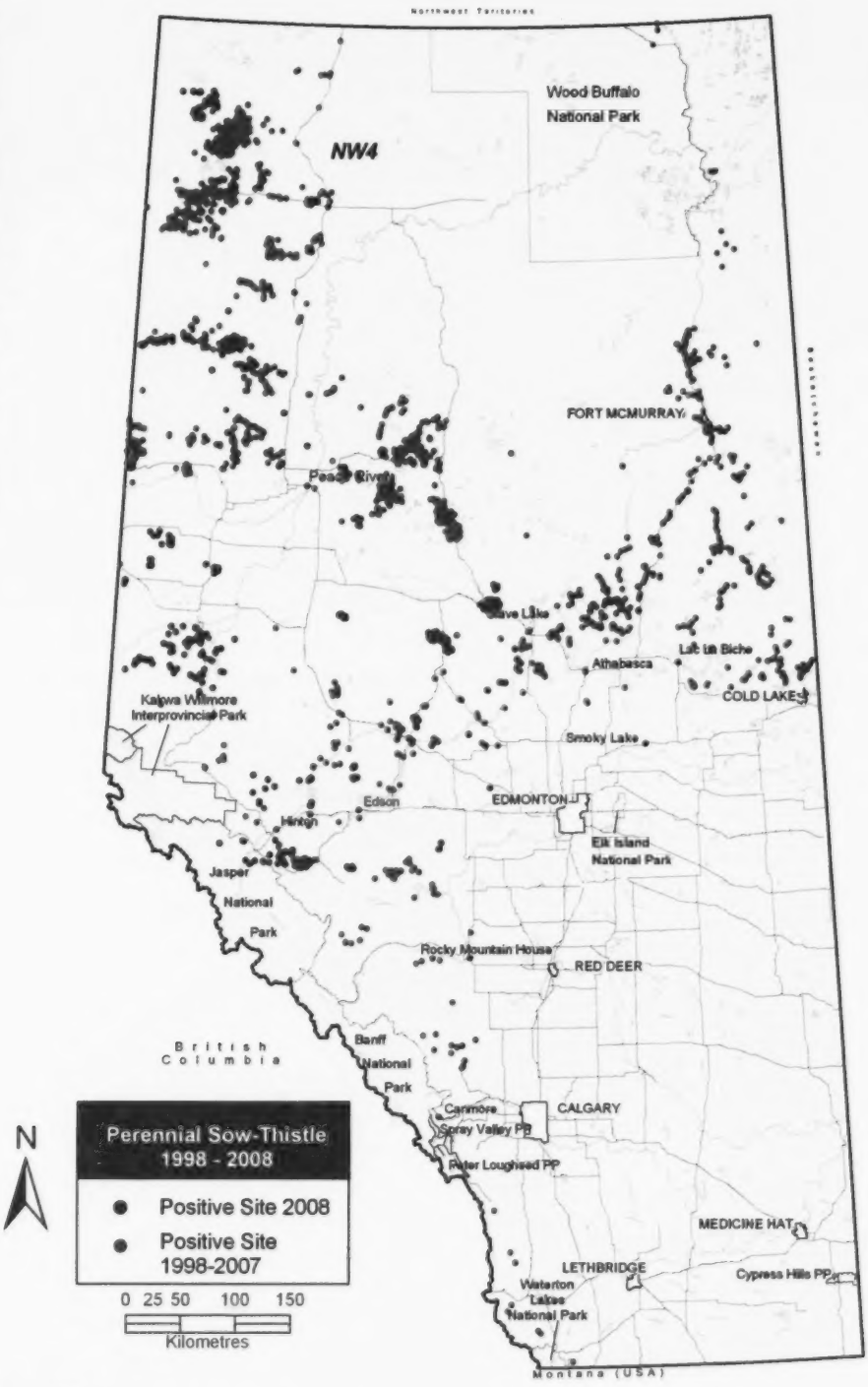


Figure 18
Occurrence of perennial sow thistle in 2008 in relation to its historical occurrence at SRD survey sites in Alberta.

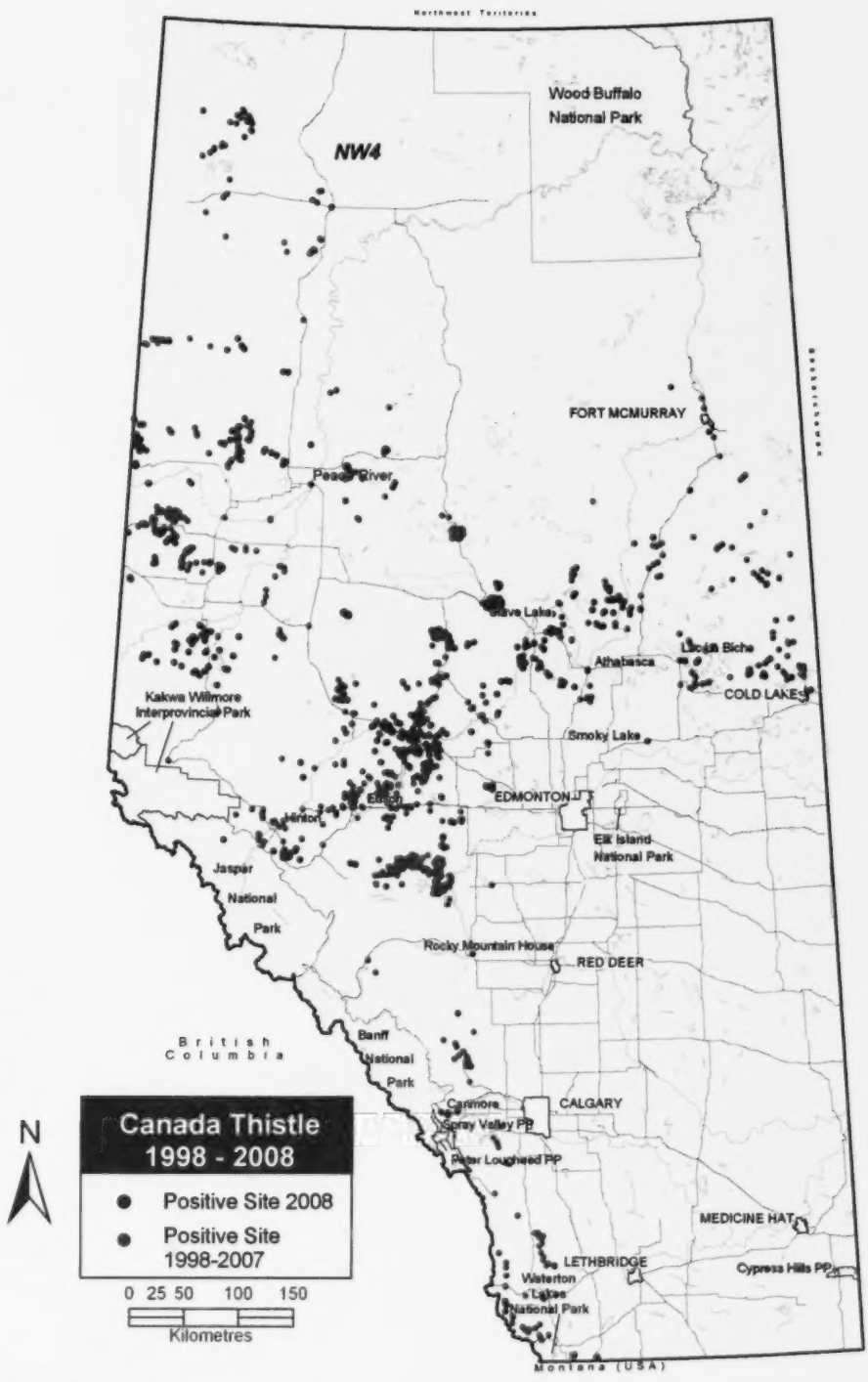


Figure 19
Occurrence of Canada thistle in 2008 in relation to its historical occurrence at SRD survey sites in Alberta.

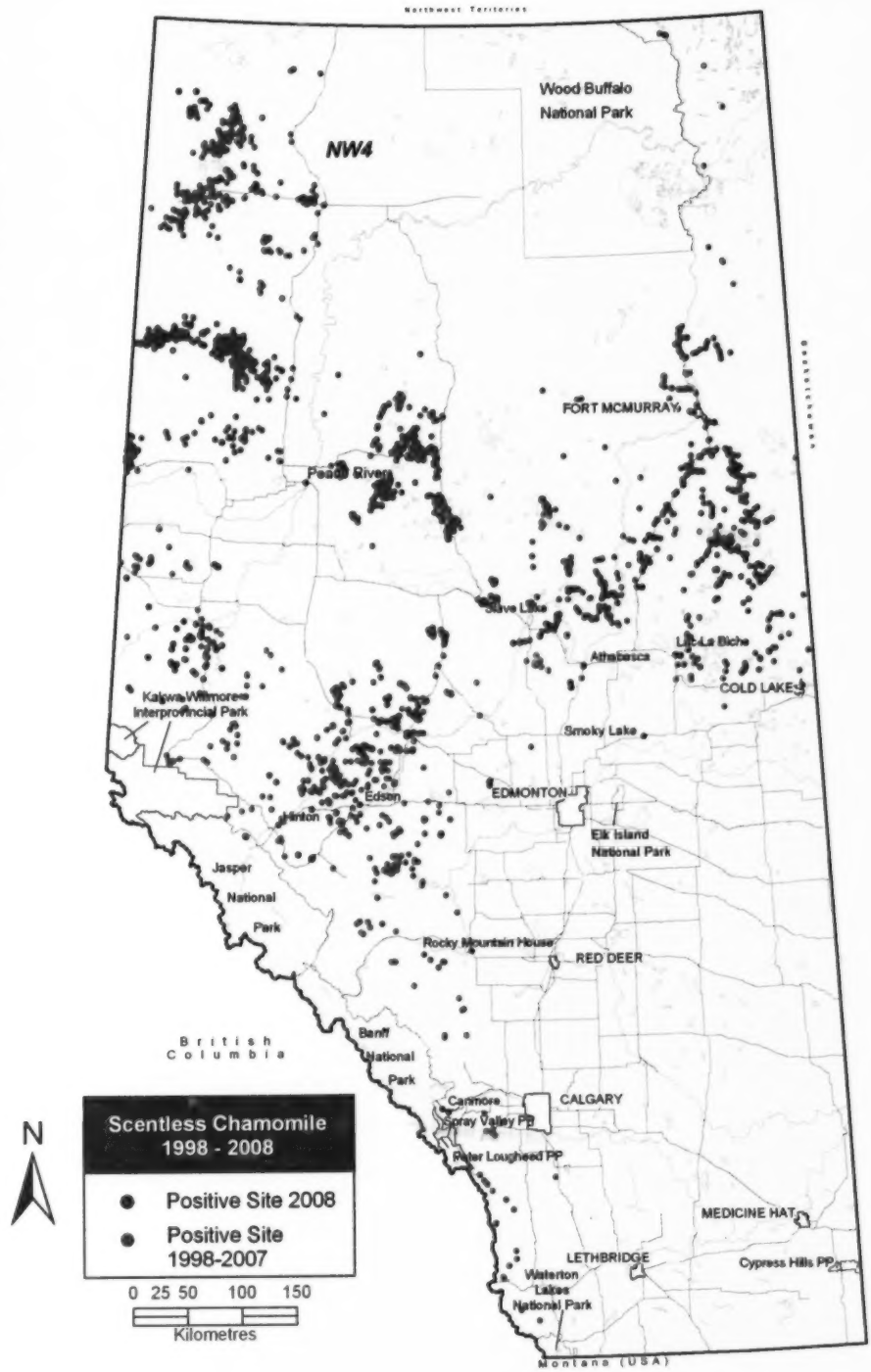
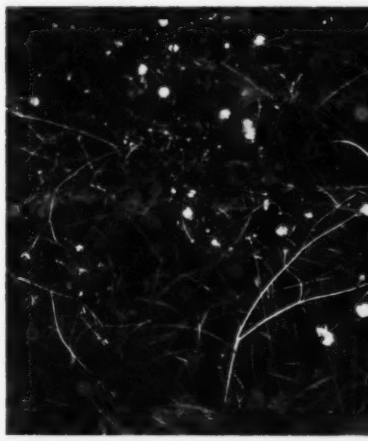


Figure 20
Occurrence of scentless chamomile in 2008 in relation to its historical occurrence at SRD survey sites in Alberta.



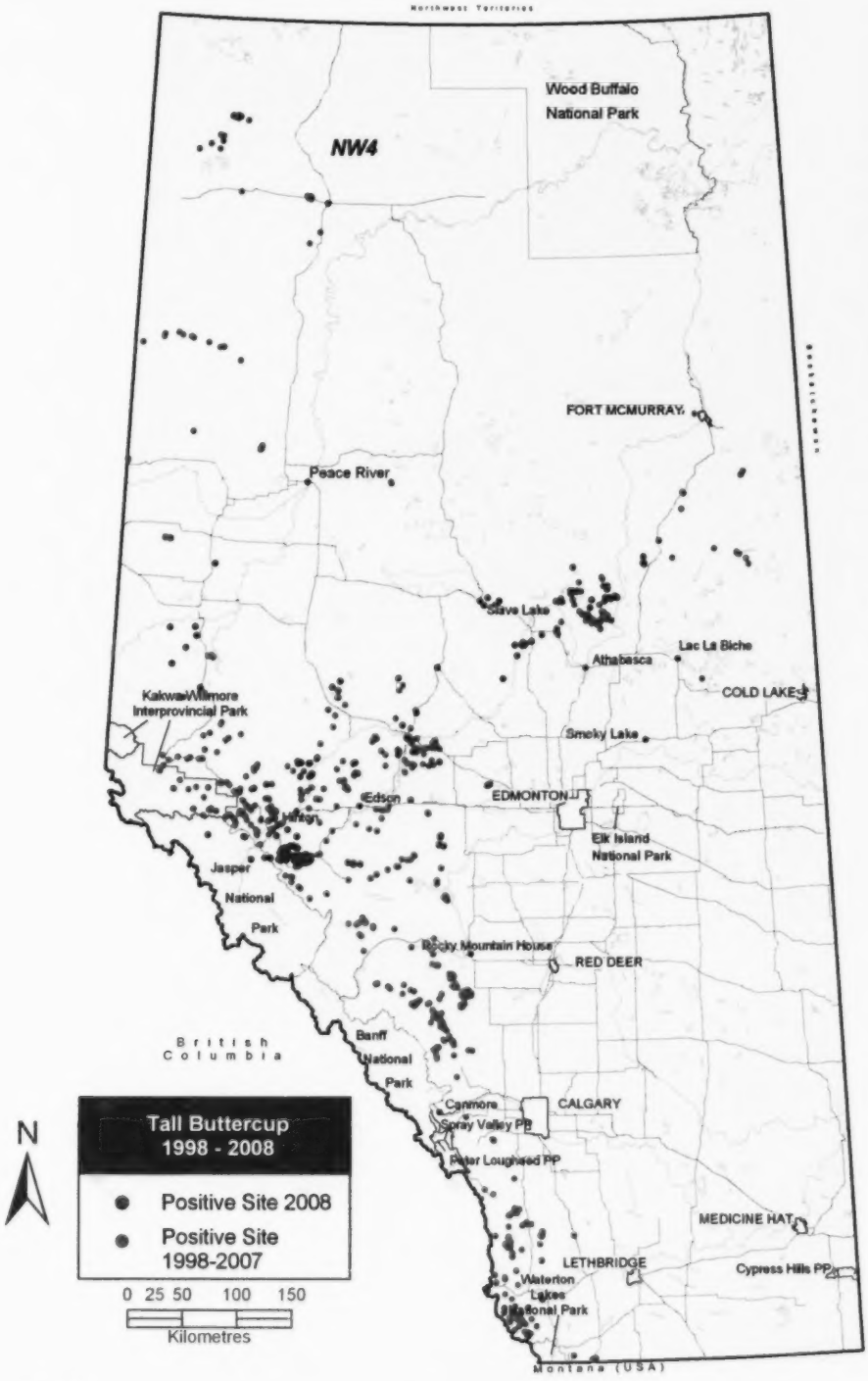


Figure 21
Occurrence of tall buttercup in 2008 in relation to its historical occurrence at SRD survey sites in Alberta.

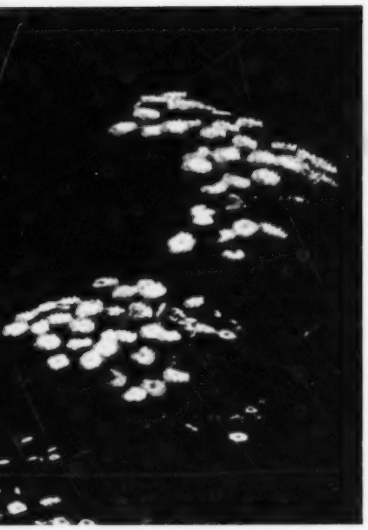


Figure 22
Occurrence of common tansy in 2008 in relation to its historical occurrence at SRD survey sites in Alberta.

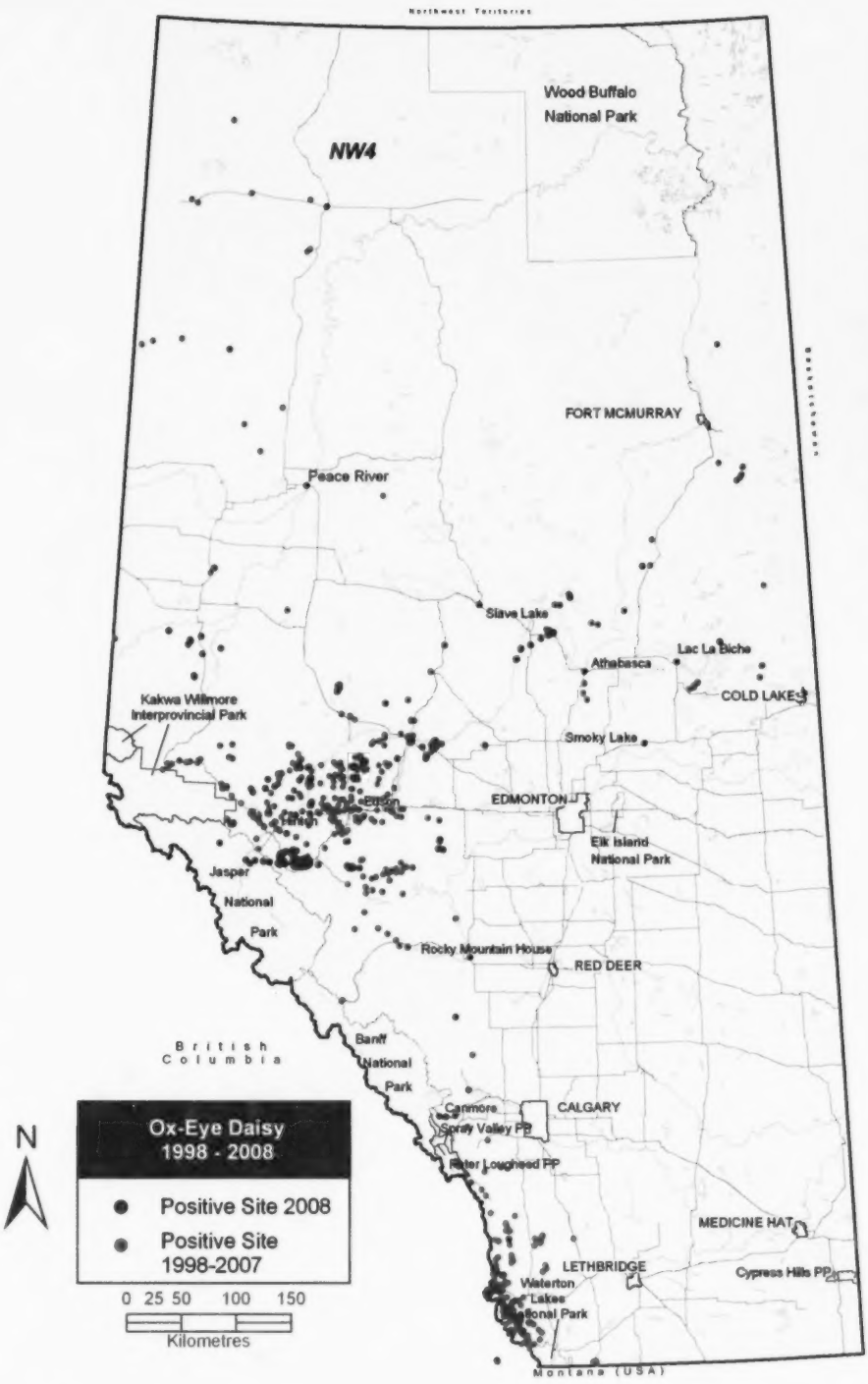


Figure 23
Occurrence of ox-eye daisy in 2008 in relation to its historical occurrence at SRD survey sites in Alberta.

Figure 24
Occurrence of common toadflax in 2008 in relation to its historical occurrence at SRD survey sites in Alberta.

Figure 25
Occurrence of spotted knapweed in 2008 in relation to its historical occurrence at SRD survey sites in Alberta.

Figure 26
Occurrence of blueweed in 2008 in relation to its historical occurrence at SRD survey sites in Alberta.

Figure 27
Occurrence of leafy spurge in 2008 in relation to its historical occurrence at SRD survey sites in Alberta.

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